MAY 7 1934

ELECTRICAL WORLD

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MAY 5, 1934
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by experience, not prophecy

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Considerable interest has been manifested in electrical utility circles by the Murray Disconnect Plug, commonly known as a dummy plug and designed for the purpose of effectively disconnecting electric service at the meter. The fundamental purpose of inserting the dummy plug in place of the ordinary fuse plug at the time of disconnection is to definitely terminate the supply of service and prevent the ever-present practice of unofficially restoring service. This accomplishment minimizes the unauthorized use of current, and facilitates the collection of delinquent accounts, thereby reflecting an increase in revenue and a decrease in uncollectible bills expense.

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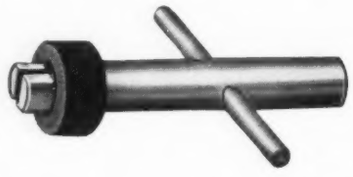

Prior to the advent of the dummy plug, the companies encountered considerable difficulty in collecting delinquent accounts, following perfunctory disconnection of service for non-payment of bills. Many individuals re-inserted fuse plugs and continued using the service, and disregarded payment of the delinquent charges. Employing the dummy plug has greatly reduced this abuse, and practically fulfills all requirements by having the service definitely disconnected. The dummy plug is readily inserted or removed, requiring only a few seconds to complete each operation.

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This useful invention has proven of immeasurable value to many utilities, and its use is perceptibly increasing. One company in a brief experiment with Murray Disconnect Plugs reports a forty-five per cent improvement in the status of its unauthorized reconnections following disconnection of service for non-payment of delinquent accounts.

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What amount would be added to your income if you were to collect 45% of your delinquent accounts at once?

[Adv.]

ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

Two Incidents

A utility subscriber writes us "There has been entirely too much talk in the industry of how badly we are abused, too much thought and energy given to proving how right we are (who cares; nobody loves a right man), too much public relations, too much politics and too little about our own business, which is to furnish electric service to the community for the least possible cost and thereby contribute our part to raising the standard of living of the people of this country. Print this thought and support it in *Electrical World*." We do and we shall.

●

There is real sales and price competition for the electrical industry to meet. That is what truly matters now. All the other things—what people say—unjust taxation—government and municipal competition—untrue statements—are conditions and facts that make the industry task more difficult, and, incidentally, more interesting. They cannot be ignored, but they should not absorb attention and energy and cause sight to be lost of the real work to be done. Competitors, such as the automotive group, are at work—improving product—making sales—lowering prices. We must meet this competition.

●

A banking executive dropped in the office last week to ask if he had better not unload utility securities. We asked why. Hs reply was: "Hostile public sentiment—increased taxes—lower rates—surplus capacity." How did he know? His supposed facts came from utility circles, where he should have been told about the good news. To look at operating property earnings. To look at the unsold markets. To look at the improved loads and load factors of late 1933 and 1934 to date. We think the banker changed his opinion before he left, but the industry needs to get out of defeatist mood before public opinion will react more favorably utility-wise.

L. W. W. MORROW, Editor

E. R. SEARLES, Managing Editor · A. E. KNOWLTON, Associate Editor · G. F. WITTIG, Statistical Editor · EARL WHITEHORNE, Associate Editor

FRANK R. INNES, Western Editor · C. W. LEIHY, Pacific Coast Editor · H. S. KNOWLTON, New England Editor · PAUL WOOTON, Washington Correspondent

JAMES H. RUDD
Manager

May 5, 1934

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ELECTRICAL WORLD

Established 1883—McGraw-Hill Publishing Company, Inc.

for the Week Ending

May 5, 1934

L. W. W. MORROW, *Editor*

Away with Gloom—Look at the Figures!

A stockholder in numerous corporations was recently commenting on the improving tenor of annual reports. The statements of the power companies this year, he said, have been the gloomiest of all. He pointed out the relatively small losses in volume, which the electric utilities have suffered throughout the depression, as compared with the manufacturers of capital goods, for example, and cited the steady growth of load that they are now enjoying. In the face of present pressure on rates and taxation, he wondered why they should weaken public confidence by these expressions of doubt and fear.

The message of President Fogarty of the North American Company to his stockholders, last week, was in marked contrast. He struck a keynote of confidence in discussing the present position of his subsidiary companies. Their rates are low. There is ample capacity to take on a substantial growth of load and materially increase net earnings. The year has started well. The output for the first quarter is greater than any three-month period since 1930. The number of residential customers has increased steadily since May, 1933, and is now larger than ever before. In short, despite the fact that 17½ cents out of every dollar of its electric revenue now goes to taxes, and regulation is increasing, with federal "yardsticks" looming ahead, this utility company is facing the future with courage and optimism and frankly saying so.

To see how good a basis there really is for such assurance, it is only necessary to study the ELECTRICAL WORLD annual survey of the 172 hundred-million-kilowatt-hour systems published with this issue. It shows that 137 power companies, representing 93 per cent of the industry, sold 11 per cent more industrial power in 1933 than the year before. This means that, though the first half of 1933 was way under the 1932 level of production, the backswing in industry through the last six months carried the load up and over the previous year's total. All classes of load showed a 4 per cent increase.

BUT it is now 1934. Energy output has been rising lately so fast that last week's total was only 3 per cent under the same week of 1930, when we had the highest all-time spring production. Total capacity is only 5 per cent more than at the end of 1930, 15 per cent over 1929. And margins between peak loads and station capacity are shrinking. As Mr. Fogarty said of the North American system, "any large increase in business above present levels will necessitate expenditures for additional transmission and distribution facilities." This means that as the factories of the country continue to come back on the lines, with gradually swelling employment and heavier load, the power industry will be building again, and electrical manufacturers will be busy and distributors and installers of equipment also.

It is time for the power companies to proclaim their strength and their future. Gloom will not help them solve either the problem of rates or the problem of taxes. But confidence and optimism will do something better than that. It will help work out the problem of market development, through which improved load factor will come and lead to greater earnings. And that is about all that's needed.

National Power Survey on Co-operative Basis

As announced by the Federal Power Commission, representatives of that board, of public plants and of private electric light and power companies have agreed upon co-operative action in the conduct of the national power survey authorized by Congress.

If the general agreement of the conferees (page 665) be followed, the survey and rate investigation may well be "helpful to the executives of public and private plants in the future economic development of the nation's power resources." It is indeed wise that "full co-operation should be accorded in the compilation of the detailed statistics required."

Here is the opportunity for a true yardstick evaluation of private versus municipal and federal operations of light and power enterprise. In the hands of the Federal Power Commission rests the conduct of a survey which may mean much to the future of a great industry as well as to concepts of government in business. It is only necessary that the survey and conclusions be made with full fairness and integrity.

Supreme Court Should Determine Validity of Contract Rights

Several recent court decisions in electric utility company cases cannot be reconciled readily, and undoubtedly the Supreme Court will be called upon ultimately to clarify the situation. Last week, for example, the United States Circuit Court of Appeals in St. Louis reversed the decision of a lower court and ruled that a franchise right granted to a utility does not transcend the right of the municipality to build a competing system (ELECTRICAL WORLD, April 28, page 634). The court applied the "universal rule that grants of special rights or privileges are to be strictly construed in favor of the public right."

In the past year or so a number of court decisions which cover several types of business have abrogated contracts on the broad premise that public interest or right is paramount. While a sound thesis, this leaves an impractical method for conducting business. It is also unfair because the courts place themselves as judges to decide upon an opinion basis and not a factual basis. Who can determine what is or is not in the ultimate public interest? The right of contract is the basic law of business; it has been found to be the only way that long-term business can be conducted.

As a matter of policy, the lawyers should consider carefully these trends in court decisions. They are very disturbing to business and to laymen appear more political than legal. Sooner or later the Supreme Court must face and act upon this perplexing legal situation.

New Researches Modify Simpson Lightning Theory

Research to get more fundamental data on lightning continues. Last week Dr. B. F. J. Schonland of South Africa told the American Meteorological Society of his research (page 666). The fundamental Simpson theory of lightning developed in clouds was modified to some extent. It is held that water drops build up potentials of 25,400 volts to the inch; the top of the cloud is positively charged, while the base of the cloud is negatively charged; large water drops are positive and small ones negative; 90 per cent of the discharges occur within the clouds and the most damaging strokes to earth occur when no rain falls from the clouds.

High-speed photographs show that strokes to earth are first started by a discharge from the negative base of the cloud to the positive earth at speeds ranging from 810 to 19,900 miles per second. The main discharge then flows from earth to cloud along the same path. The length of the leader or first discharge was from 1.6 to 4.7 miles and the longest time was 1,670 millionths of a second for the 4.7-mile stroke and the shortest time was 69 millionths of a second for a 3.5-mile discharge.

Recent researches on lightning discharge currents by the Detroit Edison Company, field researches on the Alps, in South Africa and in this country and high-voltage laboratory work promise to add to the conclusions of Dr. Schonland and to give other valuable data. It is necessary to understand the fundamental nature of lightning and to get the extremes of potential, current and time before economic and intelligent protection against lightning can be had. These disclosures of Dr. Schonland give further evidence that lightning can and will be mastered.

1933 Energy Data Point to New Era of Expansion

This first detailed analysis of 1933 production of the major utility systems of the country presents some interesting and encouraging facts. Power peaks are increasing. Margins of space capacity are shrinking. There is a pronounced rise in wholesale consumption as a result of the industrial upswing. The need for new utility construction draws near. A digest of *Electrical World's* annual supplement of 100,000,000-kw.-hr. companies, published with this issue.

WHOLESALE energy purchases from large electric light and power companies during 1933 exceeded the amounts in 1932 by 11 per cent while total energy consumption was up 4 per cent. This happened in the face of abnormally curtailed activity during the first half-year. The succeeding upturn wiped out the deficiency, then began to pile up an excess. The ground thus gained is being held. At present the utilization of energy is overshooting the figures for 1933 by 15 to 20 per cent.

Based upon a survey just completed by ELECTRICAL WORLD, the Annual Supplement accompanying this issue presents returns from 172 large utility systems on the North American continent. Of these systems—all in the 100,000,000-kw.-hr. class—137 are purveyors of electric light and power in the United States. These operated 90 per cent of the industry's total capacity and generated 93 per cent of the entire output.

Table I* compares output and peak loads of these systems for each of the past seven years. Table II* gives the installed capacity of both hydro and fuel-operated plants, the energy allocation among eight different classes of users, the number of customers in each class and the amount of energy lost or unaccounted for.

The present list includes 25 companies in the United States (two more than in 1932) that had an output exceeding 1,000,000,000 kw.-hr. Of these, all but two surpassed their figures for 1932. Peaks also were generally larger. Of the same 25 companies, 23 reported system peaks, and of those sixteen were higher than in 1932. Only sixteen of them gave the necessary information for comparing generator peaks; in half the cases there was an increase, in several instances a large one.

*Supplement.

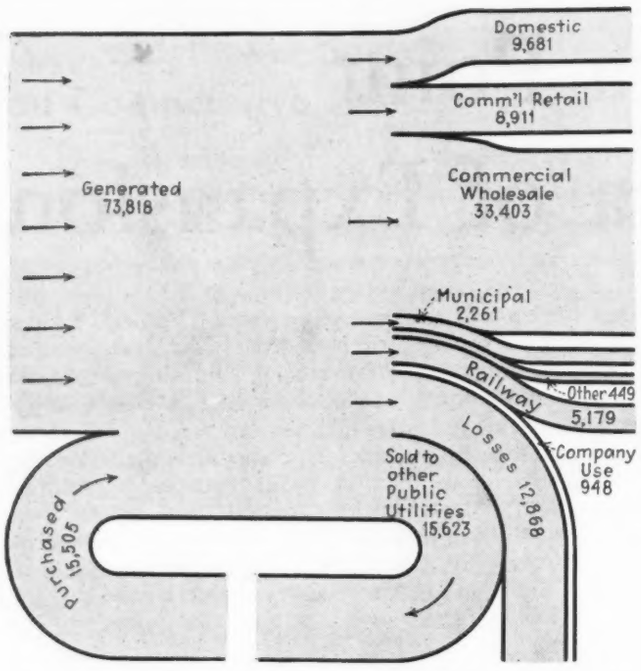
Increase in wholesale power

The first stages of recovery from the abnormal industrial conditions prevailing in 1932 are apparent from Table III. Although the improvement affected only the second half year's operations, the ratios of the three major classes of energy to total sales have already approached those of 1931. Wholesale commercial sales in 1933 constituted 37.4 per cent of total sales to ultimate consumers, against 34.6 per cent in 1932 and 37.6 per cent in 1931. This contrasts with 44.1 per cent in 1929. Other classes, in consequence, diminished slightly in relative importance. The pronounced diminution in the minor group, "Other Sales to Ultimate Consumers," is due in large part to reallocation of sales in 1933, separating out energy for farm and rural customers where possible. This energy in former years constituted a large share of "other sales."

Table III—Allocation of Output of Major Light and Power Systems, 1929 to 1933*

Class of Service	137 Systems in 1933*			144 Systems in 1932			142 Systems in 1931			142 Systems in 1930			137 Systems in 1929		
	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales
Domestic†	9,681	10.8	16.2	9,814	11.3	17.0	9,694	10.2	14.9	8,860	9.1	13.1	7,561	8.0	11.3
Commercial retail	8,911	10.0	14.9	9,089	10.4	15.7	9,603	10.1	14.8	9,836	10.1	14.5	9,184	9.7	13.7
Commercial wholesale	33,403	37.4	55.8	29,993	34.6	51.8	35,633	37.6	54.9	38,934	40.2	57.3	41,752	44.1	62.5
Municipal	2,261	2.5	3.8	2,512	2.9	4.3	2,576	2.7	4.0	2,501	2.6	3.7	2,230	2.4	3.3
Other sales†	449	0.5	0.7	1,231	1.4	2.1	1,715	1.8	2.6	1,572	1.6	2.3	971	1.0	1.5
Railway operation	5,179	5.8	8.6	5,234	6.0	9.1	5,698	6.0	8.8	6,209	6.4	9.1	5,149	5.4	7.7
Used by ultimate consumers	59,884	67.0	100.0	57,873	66.6	100.0	64,919	68.4	100.0	67,912	70.0	100.0	66,847	70.6	100.0
Other public utilities	15,623	17.5	.....	15,690	18.0	.....	15,960	16.9	.....	14,945	15.4	.....	13,290	14.0	.....
Used by companies	948	1.1	.....	953	1.1	.....	1,044	1.1	.....	1,019	1.0	.....	1,395	1.5	.....
Losses, etc.	12,868	14.4	.....	12,397	14.3	.....	12,906	13.6	.....	13,225	13.6	.....	13,199	13.9	.....
Total	89,323	100.0	.....	86,913	100.0	.....	94,829	100.0	.....	97,101	100.0	.....	94,731	100.0	.....
Company use plus losses in per cent of generated	.....	18.7	.....	.....	18.7	.....	.....	17.5	.....	.....	17.3	.....	.....	17.9	.....

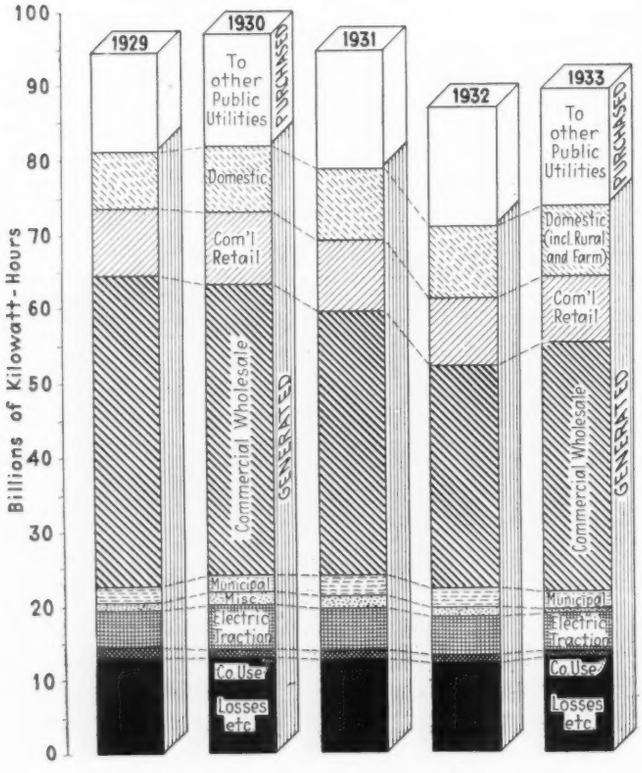
*In each year the allocation in a few of the returns was incomplete and estimates had to be used. †For 1933 farm or rural, reported separately by many companies, has been combined with Domestic except in Pacific states where it is included under "Other sales."



Industries use more than two-thirds of the energy sold

Production and distribution of 137 large systems in 1933.

This reallocation accounts also, in some measure, for the decrease in average sales to domestic customers indicated by Table VI, bringing the national average down to 598 kw.-hr. from 618 kw.-hr. in 1932. The decrease was most pronounced in the Pacific States, where large blocks of energy are sold for irrigation and some of the "domestic" sales may in the past have included such agricultural sales.



Wholesale energy use increased in 1933

Five-year comparison of output of 100,000,000 kw.-hr. systems.

Farm use largest in West

For the first time an effort was made to segregate energy used by rural and farm customers. Many of the reporting companies were unable to give this item separately—perhaps in most instances because it was not a large one. Data were received, however, for 384,167 such customers, or roughly 2 per cent of the total of all classes.

The resulting regional averages are assembled in Table IV. In the more populous parts of the country they are only moderately larger than the averages for domestic. In the South and West, however, the difference is more pronounced, and in the Pacific States the effect of the irrigation load brings the average above 11,000 kw.-hr. annually. Total energy reported in that section for farm customers exceeded 1,000,000,000 kw.-hr. All other sections combined show less than one-third of that amount.

Obsolete plants eliminated

As summarized in the insert at the bottom of Table II*, the reporting companies in the United States operated 1,863 plants, about equally divided between hydro and fuel, with an aggregate rating of 30,473,841 kw. and a generated output of 73,818,036,915 kw.-hr. The totals for the entire industry were 33,970,602 kw. and 79,983,339,000 kw.-hr., according to the U. S. Geological Survey. In the preceding year the reporting companies operated 1,884 plants rating 30,678,632 kw. The coverage in the two years was almost identical, except for two companies of which the output of 1933 was under the designated limit and which did not report. One company reported a large number of small plants in the latter year, not included before. Making allowance for these changes, there was a decrease of 38 in the number of plants and 126,789 kw. in aggregate rating. Comparison of the supplements for the two years will show where these changes were made.

Paralleling the gradual increase in purchased energy indicated in Table V, the companion item "Sales to Other Public Utilities" for resale has likewise been growing. Moreover, the two have almost exactly balanced, year by year. This equality, which applies only to the country as a whole, is brought out by the chart showing allocation of output during each of the past five years.

Special features of individual reports

Several companies reported negative quantities under "purchased" energy, making the total output less than the generated. The meaning of this is that they interchanged energy with neighboring systems and reported the net of this interchange, which happened to result in a deficiency of receipts compared with their contributions.

In some returns, the designation of classes was changed, for example, from "domestic" to "residential," or "number of bills" was substituted for "number of customers." In Table II* the items were entered under the most nearly corresponding head, without burdening the table with additional notes. "Free service" has been

**Supplement.*

Table IV—Average Energy per Farm or Rural Customer Separately Reported

New England	652	West No. Central	827	West So. Central	2,420
Middle Atlantic	823	South Atlantic	1,354	Mountain	1,215
East No. Central	707	East So. Central	901	Pacific	11,390

United States average, per customer separately reported **3,375**

Table V—Comparison with Entire Light and Power Industry

	1933	1932	1931	1930	1929
Major systems					
(a) Number	137	144	142	142	137
Energy, million kw.-hr.					
(b) Generated	73,818	71,636	79,491	82,194	81,561
(c) Purchased	15,505	15,277	15,338	14,907	13,170
(d) Sum, (b) + (c)	89,323	86,913	94,829	97,101	94,731
Total Industry in U. S.					
Energy, million kw.-hr.					
(e) Generated	*79,018*	*77,868*	*86,663*	*89,952*	*91,421*
Ratio (b) / (e), per cent	93	92	92	91	89
Rating, thous. kw.					
(f) Major systems	30,474	30,679	29,912	28,908	25,912
(g) U. S. total	*33,494*	*34,010*	*33,484*	*31,976*	*29,559*
Ratio (f) / (g), per cent	91	90	90	90	88

Table VI—Average Energy per Residential Customer, Major Systems

	Kilowatt-Hours				
Geographical Region	1933*	1932	1931	1930	1929
United States	**598**	**618**	**605**	**551**	**492**
New England	533	532	510	467	415
Middle Atlantic	525	537	538	483	441
East North Central	598	626	610	580	526
West North Central	608	621	590	545	501
South Atlantic	712	710	661	589	520
East South Central	583	616	592	530	440
West South Central	561	542	508	470	415
Mountain	687	706	702	692	556
Pacific	780	862	861	793	635

*Farm or rural customers, where separately reported, have been included with domestic except in the Pacific region, where they are included in wholesale. The 1933 figures are not exactly comparable with other years.

included in "company use." Federal, state and county building lighting is embraced in "municipal lighting." "Company use" is intended to designate energy for such use as company office and store lighting. In some cases energy used by gas, ice and other departments of composite companies was included. Notes to that effect, even when figures were given, would have unduly encumbered the table. Some abnormally large amounts for "company use" are explained by this circumstance.

Increase in Canadian operations

Reports for Canada covered twenty systems, in contrast with seventeen last year, a total rating of 4,117,367 kw., compared with 3,605,274 kw., and a generated output approaching 16,000,000,000 kw.-hr. As these companies, in a number of instances, did not segregate sales by classes, no attempt has been made to work out Dominion averages.

Returns from one company (Maclaren-Quebec Power Company) were requested too late for inclusion in the tables. The company reports two hydro plants totaling 167,000 kw. and a fifteen-minute station peak of 40,500 kw. Generated output 206,181,300 kw.-hr.; none purchased. Distribution of energy in kilowatt-hours as follows: Wholesale, 151,827,991; other public utilities, 44,363,895; company use, 1,715,254; losses 8,274,160.

Table VII—Number of Customers of Reporting Companies

	1933*	1932	1931	1930	1929
Domestic	16,189,731	15,859,513	16,021,506	16,053,261	15,363,715
Commercial retail	2,704,331	2,611,321	2,837,248	2,702,519	2,713,658
Com'l wholesale	408,152	361,646	399,551	318,595	460,628
Sum	19,302,214	19,032,480	19,258,305	19,074,375	18,538,001
Per cent of U. S. total	79.7	78.4	78.0	77.6	76.7

*Includes farm or rual except in Pacific states

Table VIII—Changes in Regional Plant Factors 1927-1932

Generated Kw.-Hr. ÷ (Plant Kw. × 8,760)

	Expressed in per Cent					
Region	1933	1932	1931	1930	1929	1928
New England	24.7	22.4	26.0	26.3	30.1	29.2
Middle Atlantic	29.3	29.4	32.3	34.7	37.3	35.0
E. North Central	28.0	26.1	29.6	31.5	35.1	35.3
W. North Central	25.7	25.9	28.6	32.7	34.1	32.8
South Atlantic	22.2	22.4	24.6	27.0	30.9	28.1
E. South Central	24.2	22.5	26.3	26.1*	27.6	27.1
W. South Central	29.1	28.6	33.2	38.6	41.9	35.2
Mountain	29.9	24.9	34.1	45.5	48.6	49.6
Pacific	31.1	31.0	35.5	37.8	41.1	39.2
United States	**27.6**	**26.6**	**30.3**	**32.7**	**35.9**	**34.3**
Canada	**43.4**	**42.7**	**44.4**	**51.1**	**61.7**	**55.2**

*Excluding 239,700 kw. available by lease or contract.

Table IX—Comparison of Generated and Purchased Energy by Geographical Regions

In per Cent of Total (= Generated + Purchased) Output

	1933		1932		1931		1930		1929		1928	
Region	Gen.	Pur.	Gen.	Pur.	Gen.	Pur.	Gen.	Pur.	Gen.	Pur.	Gen.	Pur.
New England	77.0	23.0	73.1	26.9	78.4	21.6	81.4	18.6	83.7	16.3	81.3	18.7
Middle Atlantic	88.1	11.9	87.3	12.7	89.0	11.0	89.5	10.5	89.1	10.9	86.3	13.7
E. North Central	77.3	22.7	77.1	22.9	77.4	22.6	79.3	20.7	82.9	17.1	86.6	13.4
W. North Central	97.6	2.4	98.1	1.9	98.0	2.0	98.0	2.0	98.6	1.4	98.1	1.9
South Atlantic	69.7	30.3	76.9	23.1	79.6	20.4	83.3	16.7	83.8	16.2	86.6	13.4
E. South Central	76.3	23.7	75.2	24.8	70.5	29.5	72.8	27.2	73.2	26.8	79.7	20.3
W. South Central	86.5	13.5	82.8	17.2	83.6	16.4	84.0	16.0	83.7	16.3	85.7	14.3
Mountain	89.0	11.0	86.9	13.1	88.3	11.7	88.1	11.9	89.7	10.3	89.0	11.0
Pacific	86.0	14.0	84.4	15.6	87.8	12.2	84.6	15.4	87.3	12.7	86.3	13.7
United States	**82.6**	**17.4**	**82.3**	**17.7**	**83.8**	**16.2**	**84.7**	**15.3**	**86.1**	**13.9**	**86.5**	**13.5**
Canada	**80.0**	**20.0**	**81.7**	**18.3**	**84.6**	**15.4**	**87.4**	**12.6**	**88.9**	**11.1**	**86.6**	**13.4**

Table X—Six-Year Analysis of Company Use and Losses by Geographical Regions

Energy Consumed for Companies' Own Use, and Energy Lost or Unaccounted for, in Per Cent of Energy Generated in the Plants of Reporting Companies

	Intracompany Use						Lost and Unaccounted For						Combined Company Use and Losses					
Region	1933	1932	1931	1930	1929	1928	1933	1932	1931	1930	1929	1928	1933	1932	1931	1930	1929	1928
New England	2.30	2.10	2.05	1.28	1.56	2.71	16.49	17.42	15.82	15.35	15.20	16.90	18.79	19.52	17.87	16.63	16.76	19.61
Middle Atlantic	0.94	0.84	0.96	1.26	1.44	2.24	15.26	14.88	14.00	13.85	13.70	13.90	16.20	15.72	14.96	14.11	15.14	16.14
E. North Central	0.98	1.39	1.41	1.48	2.11	2.62	15.09	14.85	13.99	13.03	13.70	12.65	16.07	16.24	15.40	14.51	15.81	15.27
W. North Central	0.75	0.94	0.62	0.81	1.27	1.29	15.45	15.17	13.49	13.20	13.70	14.60	16.20	16.11	14.11	14.01	14.97	15.89
South Atlantic	1.76	1.90	2.16	2.06	2.23	2.12	21.04	19.55	19.10	17.90	17.02	13.00	22.80	21.45	21.26	19.96	19.25	15.12
E. South Central	1.02	1.09	1.01	1.15	4.28	3.73	19.34	20.40	18.30	19.30	18.40	18.70	20.36	21.49	19.31	20.45	22.68	22.43
W. South Central	2.02	2.17	1.78	2.08	3.23	5.14	17.43	17.65	16.43	15.40	13.75	15.28	19.45	19.82	18.21	17.48	16.98	20.42
Mountain	2.60	1.41	2.38	2.80	1.99	1.86	19.34	20.77	17.30	16.00	15.67	8.73	21.94	22.18	19.68	18.80	17.60	10.59
Pacific	1.57	1.51	1.59	1.24	2.10	1.53	24.00	24.28	22.46	23.10	23.12	24.05	25.57	25.79	24.05	24.34	25.22	25.58
United States	**1.28**	**1.33**	**1.32**	**1.44**	**1.97**	**2.38**	**17.42**	**17.34**	**16.24**	**15.78**	**15.53**	**15.20**	**18.70**	**18.67**	**17.56**	**17.22**	**17.50**	**17.58**

Ways to Control Temperatures of Electrical Joints

By EMIL G. BERN
Switchgear Division,
General Electric Company,
Philadelphia

A discussion of the importance of securing permanence in the electrical joints of manufactured equipment at the factory. The advantage of silvered joints, bolting standards, flexibility of washers and other factors to be considered if low temperature performance is to be secured.

EQUIPMENTS shipped assembled obviously must retain their contact joints in good condition through transportation and installation as well as later. Good engineering, supported by national standardization rules, frequently calls for full insulation of connections, including joints, which on factory-assembled equipments means that tightening of joints cannot be left to the installation man. The feature of compactness has also augmented the problems of heat dissipation from heavy conductors and access for attention to joints.

All of these conditions usually reflect back on one point, the importance of permanency of electrical contacts. Rules have been set down to limit the heating of the conductors, but here again is met the difficulty of determining by simple tests the ultimate temperature under actual conditions, and thus the same necessity is again created to fix the maximum permissible temperature by prescribing a minimum cross-section of conductor per unit current value. Fortunately, it is now quite generally recognized among national standardizers that the ultimate temperature of a conductor is not a function of the cross-section alone, and today fairly consistent standards of tubular and bar conductor arrangements, as well as for cable lugs, have been introduced.

Oxidation accompanies excessive temperature

Prescribed temperature limits have been guarded, not so much for the sake of direct fire hazard as for the danger of oxidizing contact surfaces with consequent heating and deterioration. Unfortunately the principal materials used as electrical conductors begin to oxidize at comparatively low temperatures, especially if electrolytic action is accelerated by moisture or certain combinations of metals. For instance, copper surfaces show a pronounced tendency to oxidize at temperatures as low as 70 deg. C., unless adequately protected against air and other oxidizing agencies. The natural aim has therefore been to seal contact joints hermetically, as far as feasible, in a manner that does not prevent free dissipation of heat from the conductor and joint.

A soldered joint between two contact surfaces has been recognized as almost perfect because of its sealing effect against corroding substances, even though such surface treatment introduces, strictly speaking, a metal path of higher resistance. The brazed joint is usually considered as a homogeneous conductor. Obviously, the soldering of a bolted or clamped joint is not often the most convenient method of sealing it, and the more convenient method of covering the surfaces with some kind of slushing compound has become an almost universal practice for semi-permanent joints, whether these be bolted or clamped. A petroleum jelly has been found quite serviceable, except where high temperatures may cause it to flow out. For this reason a compound of higher melting point is usually preferred. Several grades of such materials are available, some of which also contain ingredients to resist oxidation.

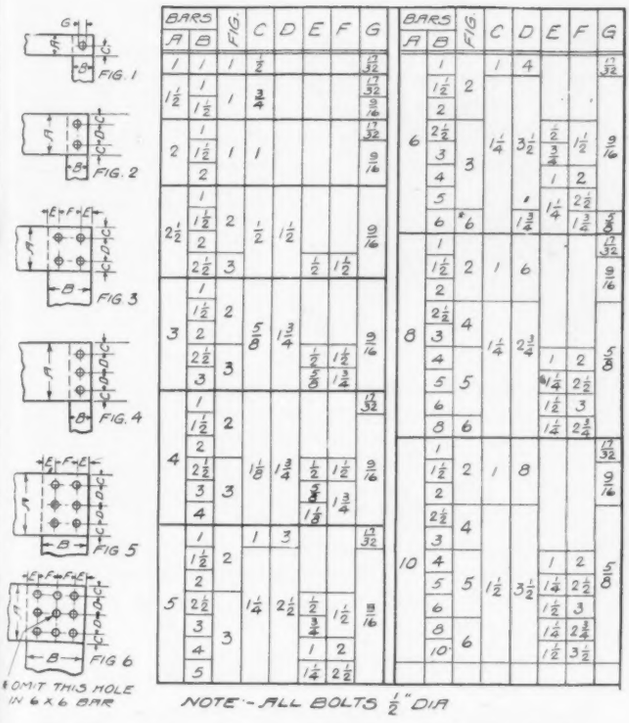
Proper surface preparation important

Surface preparation of a contact joint is of great importance and requires workmen of integrity, for no inspector can detect incipient corrosion in a bolted or clamped joint.

To illustrate this condition a case may be cited where a joint had to be opened after three months' service because of overheating. Here the contact surfaces revealed distinct finger marks, which had started the oxidation that resulted in cumulative heating, oxidation and trouble. Another case may be mentioned where resistance measurements were taken before and after exposing a bright copper surface for two hours to the atmosphere of 90 deg. C. and the result indicated an increase up to 60 times the original resistance.

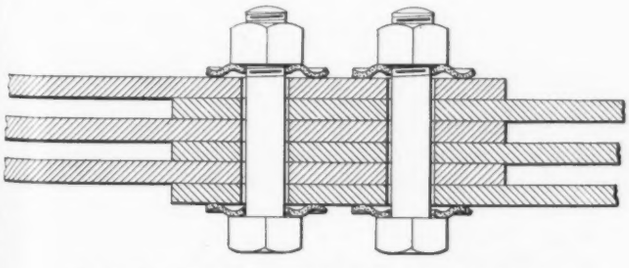
The method of cleaning is less important than that the surfaces be not exposed to the atmosphere or to the touch of the hand. The cleaning should therefore be done under a film of oil or petroleum jelly, which should not be removed until squeezed out when the surfaces are joined together. When using a heavier slushing compound this should be brushed over the surface immediately before the joint is made. If oil or vaseline has been used in cleaning, there is no harm in such extra grease because it will flow out when setting up the joint, and the amount of slushing grease that will remain is just sufficient to seal the joint.

Formerly the general opinion held that a certain area of contact surface was required per unit current to assure



Bolting of bus and connection bars standardized

Method of bolting rectangular buses and connection bars, using ½-in. bolts throughout and coinciding in general with the N.E.L.A.-N.E.M.A. cable lugs (see N.E.M.A. Publication 101). This design is applicable to either copper or aluminum and covers a wide range of bar sizes generally used in power plant work. Certain uniformity has been maintained for reasons additional to the cable lug standardization. For instance, the bolting dimensions are the same for 3-in. and for 4-in. bars, so as to permit the greatest flexibility in connecting apparatus on either d.c. or a.c. and for different frequencies. For instance, 3-in. bars may be used for direct current and 4-in. bars may be connected to the same device for alternating current.



Bolted joint with expansion washers gives sustained joint pressure

These expansion washers for ⅜-in. steel bolts, of proper tension and strength to hold the joint at a permanent tension of at least 2,500 lb. per bolt, and so designed that they will not take a permanent set within the elastic limit of the bolt. Such a construction is recommended for cases where severe service is contemplated and also where corrosive atmosphere may tend to penetrate the joint.

permanency of the joint. This empirical rule had its foundation in the fact that the larger surfaces gave a better seal to the joint, although the actual number of contact points might not be increased by the relatively larger surface. It has been repeatedly demonstrated that the effective contact is the sum of the minute points of the contact surfaces which under pressure flow into intimate contact.

Two polished surfaces ground together would not make as perfect a contact under ordinary pressure as would two rough surfaces. In the former case the pressure would be evenly divided over the entire surface and hence not sufficient to cold flow the metal of one surface into perfect union with the other, while a concentrated pressure on a relatively small number of points or lines would readily flow the metal together and at the same time drive out the superfluous compound at the edge of the joint. The limit of such point or line contact joint has been found to be, not the old rule—so many amperes per square inch contact surface—but the total cross-section of the meeting points or lines.

This has been established by cutting a contact surface to resemble a file or a rasp, clamping this surface to another smooth surface covered with wax of known melting point and passing through the joint a current of sufficient value to melt the wax. The sense of smelling usually announces the start of melting before the wax can be seen flowing out of the joint. After dismantling the joint the contact points or lines are readily measured and the total cross-section of the joint established, which is found to correspond closely to the combined cross-section of all minute joints.

From this it is evident that the current rating of a joint depends very largely on the available pressure on the points, lines or spots of a contact. It is a matter of pressure per unit cross-section of the metal making up the lines or points.

Standardized bolting fits contact requirements

Sizes of bolts in electrical joints are of great importance, because the pressure must be adequate to establish a permanent contact without subjecting the bolts to stresses beyond their elastic limits. Larger bolts have an advantage in this respect because they do not reach their elastic limit so readily when joints are tightened by the ordinary hand wrench and under ordinary hand pull. For instance, a standard ½-in. steel bolt can be subjected to a pull of 52 lb. applied at the end of a standard wrench, while the corresponding ⅜-in. bolt must be limited to about half this pull, which is a small and rather indefinite margin in the strength of the human arm. However, compact equipments will not permit the use of very large bolts with correspondingly larger wrenches. For ordinary power equipment work the ½-in. steel bolt gives the most satisfactory service. This was given careful consideration by the N.E.L.A.-N.E.M.A. joint committee on standardization of multi-bolt cable soldering lugs.

The spacing of bolts is also a matter to consider in connection with the choice of bolt sizes and thickness of the individual bars in the conductor. In this respect cable lugs and rectangular bar conductors should be subject to the same standardization rules, as far as feasible.

Lock washers of the conventional type should be avoided next to the copper conductor, out of consideration for the copper bars in the event of dismantling the equipment. Lock nuts are preferred, but lock washers may be used on top of plain washers if provision has been made to prevent the latter from turning or slipping on the copper surface.

Locking of joints thwarts vibration loosening

Permanently tight joints have always been a problem in electrical construction work, partly due to vibration, and also to expansion and contraction in joints at changes in electrical load. Vibration may affect the joint in two ways; first, the nut or the bolt may simply jar loose be-

cause of less friction in the thread than between the nut or bolt head and the washer, or, because of insufficient tightening, the contact surfaces may not have properly joined to support firmly each other, and as a result the vibration may hammer or grind down the tops of the contact points or lines until the joint becomes virtually a lubricated hinge.

Many installation men have had this experience, and, without knowing the real reason for the trouble, they have established the practice of going over all joints and tightening them to the limit some time after the equipment has been placed in service. It is usually found that quite a bit of tightening can be done. This may not entirely be due to vibration, but is always due to movements or to stresses in the joints which may be caused partly by expansion to the extent that the tops of the contact joints or lines have been battered or pressed down until the joint has lost its tension or life. All this is due to an imperfect setting up of the joint in the first place. Some installation men have adopted the practice of tapping the joints with a hammer at the time of drawing up the bolts to just below their safe elastic limit, so as to help overcoming the friction in setting up the joint.

Flexibility in joints to meet temperature differentials

Expansion and contraction of joints because of changes in electrical load is a matter that must be given due consideration in proportion to the thickness of the joint. By comparing the coefficients of linear expansion of different materials used as conductors and bolts, which are, approximately, copper 0.000016, aluminum 0.000022, zinc 0.000025, steel 0.000012 per deg. C., it is clear that greater electrical load with resultant higher temperature will tighten the joint, but at the next temperature reduction a corresponding shrinkage of the conductor takes place which tends to open the joint, unless properly sealed. The action of the differential expansion is augmented by the fact that the bolts do not heat as fast as the conductor; first, because they do not carry the current, and, secondly, they are not in heat-conducting contact with the conductor. For instance, it has been found during heavy short circuits of sufficient magnitude to anneal the contact surfaces that the bolts have remained cool for an appreciable length of time.

Up to certain limits in thickness of joint, and especially if the load cycle is not too extreme in range and occurs too often, it is sufficient to draw up the bolts tight and lock them, provided that the bolts are not pulled beyond their elastic limit. For severer conditions a feature of flexibility must be introduced.

By a special shape of the clamping surface to maintain pressure on the original points, or by making these clamps of a special steel, with elastic tension arms for the clamping bolts they maintain a permanent joint pressure. These clamps are usually made of non-magnetic steel for heavy alternating current conductors, to avoid inductive heating.

Flexible joint with expansion clamps of non-magnetic steel

In many cases it is considered more advantageous to clamp the joints rather than to bolt them, because of greater convenience to install and also in the event of future changes or extensions. For clamping under severe conditions, where the feature of expansion is desirable, there are available clamps designed to maintain permanent pressure.

Silver contacts afford smaller joint areas

So far this article has considered permanent contacts in conductors under ordinary space limitations, where fair-sized contact surfaces with proper treatment can be relied upon as seals against oxidation. There are, however, cases where further compactness in size of equipment is thoroughly feasible and where contact problems have in the past been the only limitation. As an example of this may be cited buses assembled with metal-clad switchgear units, where caution born of old experience might cause one to hesitate to approve the convenient installation feature of bus joints between the individual units. Here space and adequate insulation are of prime importance. However, one of today's most epoch-making applications of old knowledge has come to the rescue—the use of silver contacts, not only as movable contacts but also in permanent joints.

The fact that silver oxide is a good conductor, while that of other metals is usually as good an insulator, has long been common knowledge, and all that recent scientific research has been able to add is a confirmation of this fact after investigating the behavior of about sixty different metals and alloys. The problem up to recent time has been how to apply the silver surface economically to the conductor, and on movable contacts how to obtain a hardness of surface to resist wear. Manufacturing processes have scored another victory, and today there are available silver contacts for permanent contact joints as well as for switching contacts in apparatus.

Considering that with silver contacts under ordinary conditions it is unnecessary to provide a protective seal against oxidation, it is evident that the contact surfaces may be reduced, even to an extent bordering on elimination. By this is meant that the meeting points may be formed into lines, ridges, or individual peaks, covered with silver, and cold flown into homogeneous union under high pressure per unit area. This is some-

Approximate Current to Raise Temperature of Copper Conductor of Given Size, in Given Time, From Normal Temperature of 70 Deg. C.

Time in Seconds	Table I: To Critical Unsoldering Temperature, 150 Deg. C.			Table II: To Melting Point of Copper, 1,083 Deg. C.		
	0.1	1.0	5.0	0.1	1.0	5.0
	Amperes			Amperes		
No. 12	1,145	362	161	2,870	906	405
No. 8	2,900	916	410	7,250	2,295	1,025
No. 0	18,530	5,860	2,620	46,300	14,650	6,550
No. 0000	37,100	11,750	5,240	92,800	29,400	13,100
500,000 circ.mil.	87,800	27,750	12,400	219,500	69,500	31,500
750,000 circ.mil.	131,500	41,600	18,600	329,000	104,000	46,600
1,000,000 circ.mil. ...	176,500	55,500	24,800	439,000	139,000	62,100
1,500,000 circ.mil. ...	263,500	83,100	37,200	658,000	208,500	93,100
2,000,000 circ.mil. ...	357,000	111,000	49,600	878,000	278,000	124,200

what the same as with the convention contact surfaces, except that the latter must have the union points or lines protected against oxidation, which is not necessary with silver. Hence the sealing surfaces are not required, provided heat dissipation has been properly taken care of. In this manner the transferring of current from one conductor to another involves very little beyond the providing of proper permanent pressure on the contact lines.

As previously explained, the present temperature specifications, viz., 30 deg. C. rise above 40 deg. C. ambient, were established to hold the temperature of a conductor below the critical oxidation point of copper and thus preserve the contacts. Oxidation of silver contacts having very little to do with the successful operation of the equipment, the aforesaid temperature limits are not of the same importance, except to comply with rules made for the other conditions.

Cable connections

There is often a mystery surrounding the overheating or failure of cable joints, and the answer is usually the same as to the question of why so many fuses blow without apparent reason—just poor contacts. In addition to the effect of heating developed at the bolted joint of the lug, imperfect soldering of the cable into the thimble is the most common source of trouble. A perfect soldering job necessitates a perfect tinning of both the cable and inside of the thimble at the time of making the joint, and without burning either member. Here again the integrity of the workmen must be the guaranty of the joint.

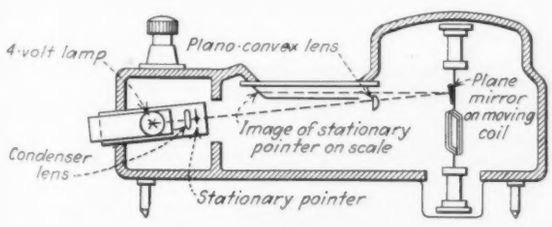
In all soldered joints, not mechanically held together by bolting or clamping, stresses must be avoided by supporting flexible or movable parts against gravity and against possible magnetic stresses. The melting point of the soldered joint must also be taken into account. This is, of course, different for different compositions of solder, but as the solder for this class of work is usually made up of half and half tin and lead, its melting point is just below 200 deg. C., with the property of becoming plastic at about 150 deg. C. It is advisable not to exceed this temperature in any ordinary soldered joint.

Table I gives, for convenient reference, the current required to raise the temperature in several different sizes of conductors from the maximum operating temperature of 70 deg. C. to the critical unsoldering temperature of 150 deg. C. This table has been calculated on the basis of zero heat radiation and on 1.589 microhms resistance per 1 c.c. of copper at 0 deg. and a temperature coefficient of 1/234 at 0 deg.

Cable lugs are sometimes proportioned so that a short time temperature rise, sufficient to burn off the cable, will not unsolder the joint. For such conditions Table II will be found convenient. The data have been calculated on the same basis as Table I and the results verified by tests. The table gives the current required to raise the temperature in the conductors from the operating temperature to the melting point of copper, 1,083 deg. C.

Sensitive Portable Meter Employs Optical Pointer

A German manufacturer has incorporated into a small portable instrument, not larger than the customary pointer type of voltmeters and ammeters, the old idea of a mirror and light-beam pointer, used on all highly sensitive galvanometers. The moving coil of the instrument (*Siemens Zeitschrift*, March, 1934) is suspended between two fine metal ribbons, making arresting during transport unnecessary. A small plane mirror is attached directly above the coil. In one end of the instrument box is located a 4-volt lamp with a condensing lens and a stationary pointer. An image of this pointer is projected onto the mirror, from where it is reflected to the slightly conically arranged scale. Since the reflected image moves twice as fast as the incident image, the coil has to move through only half the angle sustained by the scale. The instrument is, of course, readable in the dark, which is of importance for certain optical investigations.



Portable meter uses light beam as pointer

The sensitivity of this instrument is unbelievably high for a portable type. For example, a millivolt calibration for one millivolt for the entire scale or one microampere for the full scale is available. An accuracy of $\frac{3}{4}$ per cent for the scale range is guaranteed. These instruments have proved of value for photo-electric measurements.

Street-Light Economy Dangerous

Another telling blow to the fallacious idea of municipal budget economy through the cutting down of the size and number of street lights can be had from the accident statistics of New Jersey in 1933 reported by the Commissioner of Motor Vehicles. They are typical of those throughout the country.

More than 44 per cent of the accidents occurred at night and 67 per cent of the fatal accidents were at dusk or later, while only 20 to 25 per cent of the total traffic moved. During the year total accidents decreased 28.3 per cent, but fatal accidents after dark increased 8 per cent.

The International Association of Municipal Electricians has pointed out that the net savings of municipalities effected by cutting down on their street lights is too often a net loss to the community through the increase of accidents and crime.

A committee on street and highway lighting and safety of the New Jersey State League of Municipalities is now investigating the relation of adequate lighting to crime prevention and safety.

Multi-Speed Motors to Save Pulp-Wood Wastage

By F. A. NICHOLSON and L. A. BURQUE

Chief Engineer Stetson-Ross Machine Company, Seattle — Westinghouse Electric & Manufacturing Company, Seattle

This recent development in the equipment of a Pacific Coast pulp mill has perfected an ingenious application of multi-speed motors. The machine strips bark and discolorations from pulp wood logs. Thermal relays protect the motor in simple manner against overload at any speed. Power sales engineers and motor manufacturers with sawmill problems may find the experience valuable.

PACIFIC COAST timber, due to its extreme variation in size, has presented a problem to pulp mill operators in its preparation for pulp-wood. The small logs were easily handled by methods which have been in use for years, but economical preparation of the large "sticks" necessitated the development of new methods, since none of the previous machines or methods were adequate.

Previous to the development of a machine recently placed in successful operation in a Pacific Coast pulp mill various methods were used to prepare logs 22 in. in diameter and larger for pulp-wood. None of these were satisfactory because of the large percentage of waste. There was also considerable handling and labor cost involved since the logs were cut up into cordwood, in most instances, and barked manually. Some logs, particularly those cut in the spring when the tree was in sap, could be barked by spuding the bark off; that is, slipping a wedge-shaped tool under the bark and prying it off by hand.

The problem was turned over to the Stetson-Ross Machine Company, resulting in the development of a high capacity barker incorporating some interesting features and the application of flexible motor-driven cutter heads. To appreciate the difficulties encountered, it must be clear that not only the bark must be removed, but all useless fiber such as burls and rotten or fungus-infected wood that might discolor the paper. This must be removed cleanly and without waste from a section of log that may vary from 2 ft. in thickness at one end to nothing at the other, and with a surface as rough as a detour after a thaw. Evidently extreme flexibility of the cutter head was necessary, and this was accomplished as will be shown.

The logs are first prepared for the machine by slabbing in a band mill to four, six, nine or twelve sections, depending on the size and shape of the log. The slabs are then introduced to the barker and the bark and other undesirable wood removed, after which they are ready for the chipper. Operation of the barker is controlled by one man, who has at his fingertips all its various functions.

All functions under one-man control

When the cants or slabs are brought to the barker they are picked up by the live rolls and brought up to the cutter head. The live rolls are driven by a four-

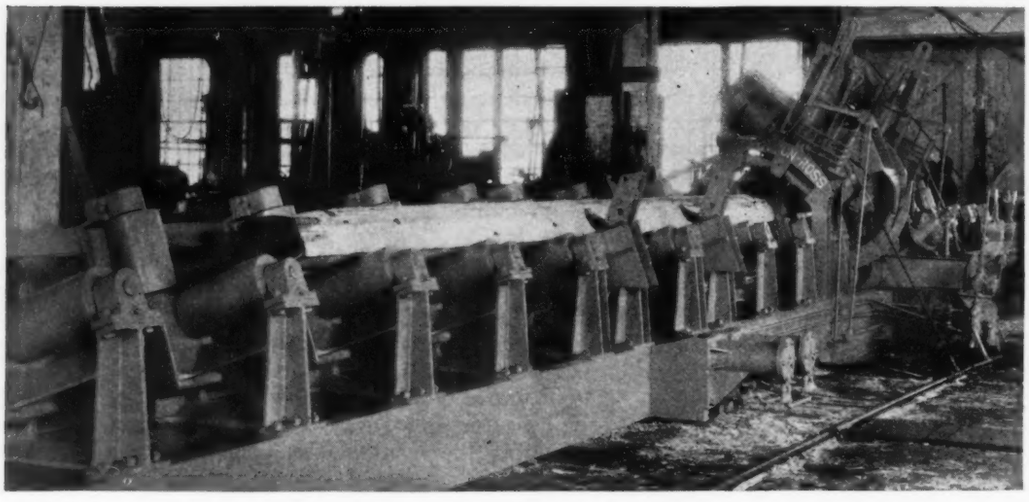


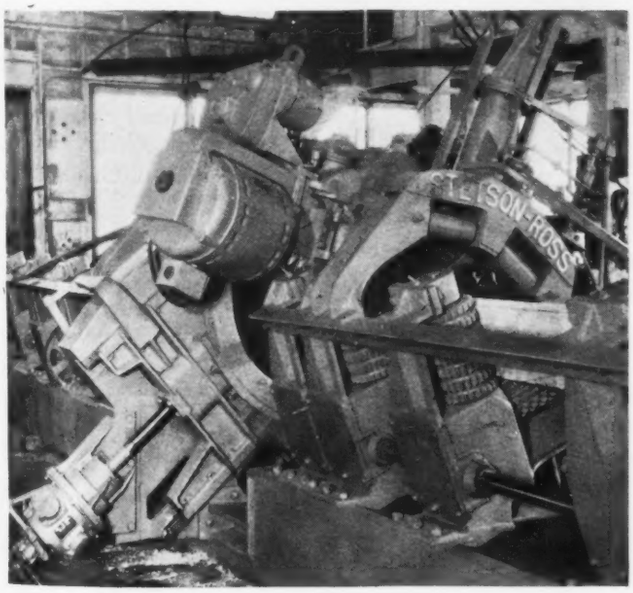
Fig. 1 — Barker trims pulp-wood logs without waste

One-man four-handle control for all machine functions. Two outer handles control the nigger (for turning the log over) and the rolls which press the cutter against the log. The two inner handles control the hoisting and the tilting action of the cutter head. Push buttons in the latter handles control the feed and slewing motors. The push-button control for the cutter head motor and the four-speed drum controller, occasional functions, are behind the operator on a column.

Fig. 2—Cutter head adjustable as to angle, elevation and pressure

Small squirrel-cage motor (2 hp,. 1,020 r.p.m. with elevator characteristics) at top center works through worm and nut to change cutter angle, cutter head being mounted on pivoted assembly on the flanged ring. The concave cutter head is driven by a 75-hp., 3,450-r.p.m., three-phase, 60-cycle, 440-volt wood-worker type squirrel-cage motor.

Fig. 3—Air motor moves cutter head carriage assembly



speed squirrel-cage motor having a high resistance rotor, providing smooth reversals and plugging with the desirable high-torque characteristics.

This motor provided a problem in protection, since to protect it against overload on all four speeds and ratings it would normally be necessary to use a control panel with separate overload relays for each speed so connected to the pole changer that each overload relay would only be in the circuit for that speed for which it was designed. This would be an expensive and complicated control panel with the attendant evil of upkeep. The problem was nicely solved and simplified, however, by the use of thermostats attached to the windings and connected to the holding coil on the contactor so that overheating the motor on any speed would cause the contactor to drop out and stop the motor. Also, the motor cannot be started again until it has cooled down sufficiently to be safely operated.

The motor is controlled by a four-speed pole changer and magnetic reversing contactor. The three low speeds are connected for the forward or cutting direction and the high speed permanently connected for reverse, so that, regardless of position of drum pole changer handle, high speed reverse is always obtainable by depressing the reverse button. Forward and reverse speeds are controlled magnetically by push buttons in the handle of the tilting control and forward speed changes when necessary are effected by operation of the drum pole changer. Those rolls immediately adjacent to the cutter head are toothed and two air-operated pressure rolls (Fig. 3) above them hold the timber against the driving rolls and steady it while being cut.

After the timber has passed through the cutter head it may be necessary to roll it to cut material off another face, and for this air-operated niggers are provided. These are controlled in the usual way by a vertical handle with four directions of movement. After the position of the slab has been changed it can be quickly passed back through the machine at the high speed reverse and then driven through the cutter head again for another cut.

Unusual flexibility in cutter head

The cutter head must be adjustable for various thicknesses. It must be movable across the face of the log and the angularity of the cutter head must be changeable at the same time in order to get all the bark, but none of the usable wood. In brief, it must simulate the movements of a Scotchman peeling a potato.

The entire cutter head assembly (Fig. 2) is mounted on a flanged ring rotating in a sliding member and internally geared by ring gear and pinion to an air motor. This motor is so controlled that definite movement of the controller handle effects a similar definite tilting movement of the cutter head assembly. Thus the operator in one slight control movement accomplishes the desired result. Push buttons for the angle-adjusting motor are located in the handle of the hoisting controller and slew-

ing of the cutter head in either direction is obtained as long as the operator holds one of these push buttons down.

The entire cutter head assembly, including the rotating flange and motor, is mounted on a carriage attached to the frame by sliding members. This movement is driven through a worm and nut by an air motor and control of this motor is similar to that of the tilting control.

Shorter Hours Create Work Schedule Difficulties

Changes in operators' hours under utility code to less than 48 complicate the question of continuously rotating work schedules as to shifts and time off.

Recent reductions in working hours bring attention to the difficulties faced by utility companies that must maintain 24-hour operation, particularly in the case of specialized tasks where, on a given shift at a given location, only one or two men are employed. Substation operation is a significant example and one utility not only has encountered difficulty in expanding its staff of trained men but has found it a perplexing matter to devise simple work-hour schedules which would conform to the code and at the same time be equitable to the worker.

The ideal schedule would give men: (1) Equal time on all shifts, (2) their days off consecutively, (3) rotation in days off (so that, for example, each man gets an occasional Sunday), (4) no rotation of shifts without intervening time off, (5) at least two shifts off between swinging from one shift to another, (6) a reasonable limit on the number of days worked in succession, and (7) the same number of hours in each payroll week. These requirements are complicated by reason of the seven-day calendar, and considerable ingenuity must be used to satisfy all of them.

Under the 48-hour schedule, where one-man supervision was required at a substation for the full 168 hours in a week, 3½ men were needed, and seven men could very nicely cover two such stations, one man serving one-half time in each. With a 40-hour week, however, each substation of this class requires 4⅓ men, or five substations require 21 men, the 21st man being obliged to divide his time between all five stations, often an impracticable if not impossible requirement. The alternative is to train more relief operators, assigning part of their time to operating and the remainder to maintenance or other work. The problem is less awkward, of course, where substations require two or more operators continuously in attendance, and is greatly simplified where five men happen to be needed at one time.

From the scheduling point of view, the ideal number of hours per week is one which is evenly divisible into 168 or 336 (twice 168), preferably the former. Thus, working 42 hours, four men can just handle one station, each man working 40 hours per week for three weeks and 48 hours the fourth week. The next lower step in reduction of hours might perhaps be to 37⅓ hours, a number which goes into 336 just nine times. This is the average of 40 hours for two weeks and 32 hours for the third week and enables a crew of nine men to cover two stations.

ELECTRICAL

Crane-Suspended Pumping Unit Speeds Pier Construction

In pumping out the caissons for piers of the San Francisco Bay bridge, engineers of Bridge Builders, Inc., conceived the idea of mounting a vertical, motor-driven pumping unit in an angle-iron frame, as shown in the accompanying illustration. The unit was then suspended over the caisson from the boom of the derrick shown in the background, it then being possible to change the position of the pumping unit at will.

This equipment was particularly valuable in preparing for the seal of concrete around the bottom of the caisson. In this operation the pump intake was a flexible tubing approximately 50 ft. long which extended to the bottom of the caisson, which had been constructed by driving steel piling into the bottom of the bay and consequently was full of water. A diver was sent down and prepared the bottom of the caisson for the concrete seal by placing the flexible pump intake in the proper place to remove the excess mud and silt around the interior edge of the piling. Through telephone communication with his tender, who in turn transmitted his orders to the derrick operator, the pump was raised and lowered and moved along the caisson as required. Power for the motor was supplied through a rubber-covered, three-conductor cable.

Automatic Rectifiers Effect D.C. Changeover

Satisfactory operation of two mercury-arc rectifiers for more than six years in supplying without interruption its d.c. elevators and building motors has shown Henry Morgan & Company, Ltd., Montreal, that its choice of rectifiers to effect the changeover of its department store to a.c. service was well advised. This was one of the early uses of rectifiers as a means of conversion incidental to change of utility distribution from d.c. to a.c.

Two 132-kw. Brown Boveri rectifier and transformer sets function on the primary supply of 4,000 volts a.c.

PRACTICE IN INDUSTRY

and rectify it to 265 volts d.c. The only real trouble experienced was with one of the high-vacuum pumps, which was caused by a pinhole leak in the internal vacuum tube connecting the inner and outer casings and passing through the water jacket. The trouble was discovered and repaired by the store company's own engineers. Their experience has shown that mercury-are rectifiers can stand tremendous overloads without any harm and that units of this size have close voltage regulation under wide load variation. Variations of 5 to 10 volts were experienced when the load was swinging momentarily from 100 to 800 amp. On occasions, when cleaning the rotary pumps, etc., one of the rectifiers was run for 24 hours and longer carrying the whole load, which goes to 800 amp. and is 75 to 100 per cent over the rating.

The annual expense for repairs and supplies has averaged $50 per year. The rectifiers operate without vibration, require little ventilation and occupy but 30 to 40 per cent of the space that would have been required by a motor-generator set requiring transformers.

Hospital's Electric Truck Solves Transport Problem

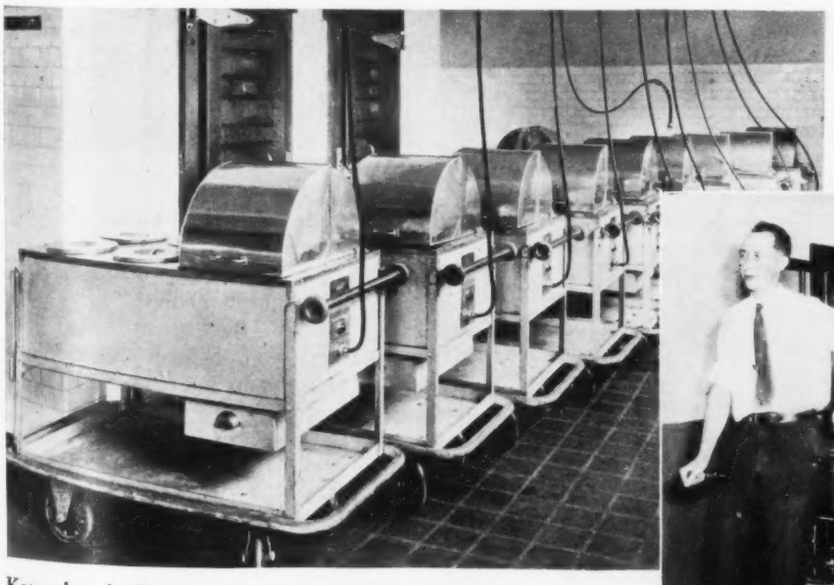
Serving of meals and handling of laundry are two sizable service problems in hospitals. They assume major proportions in as large an institutional group as the University Hospitals of Cleveland, Ohio. This group includes Lakeside, Babies' and Children's and Maternity Hospitals, Leonard C. Hanna House (private pavilion of Lakeside) and, in addition, buildings in the Western Reserve University medical group—all united by underground passages with a total length of about a mile.

Food service is, of course, on a schedule of three times a day. Laundry collection and distribution, on the contrary, is more flexible; can be dovetailed in between mealtimes; serves to iron out peaks and valleys of truck operation.

Just a standard industrial type electric truck is used, minus the usual platform lift mechanism, and equipped with rubber-padded bumpers to push through double swinging doors, protect the operator from wall corners and projections.

A 24-volt, 15-plate, 12-cell Exide Ironclad battery supplies the electrical energy. Motor drive is applied to two wheels, steering control to all four. Capable of a speed of 250 to 350 ft. per minute, the trunk will pull as much as five tons at a time, as many as eleven trailers, coupled with specially designed drawbars. Full flexibility is thus offered.

The laundry trailers, simply rubber-tired wagons with high ends, present no problems. The food trailers, on the other hand, are more complicated, involving the heating of the several compartments into which each is divided; 1,175 watts in electric strip-heaters, inclosed within compartment walls of each truck, are "plugged in" on regular 110-volt circuits to preheat the food cabinets during their loading at the central Lakeside Hospital kitchen and are "plugged in" again as they are dropped out of the food "tram" at the local service kitchens located throughout the group of buildings covered. It is no problem at all, then, to serve patients and hospital staff with meals, piping hot, and delivered on schedule.



Kept electrically heated, meals in these wagons reach their destination invitingly hot

Electric truck and trailers facilitate hospital laundry collection and distribution

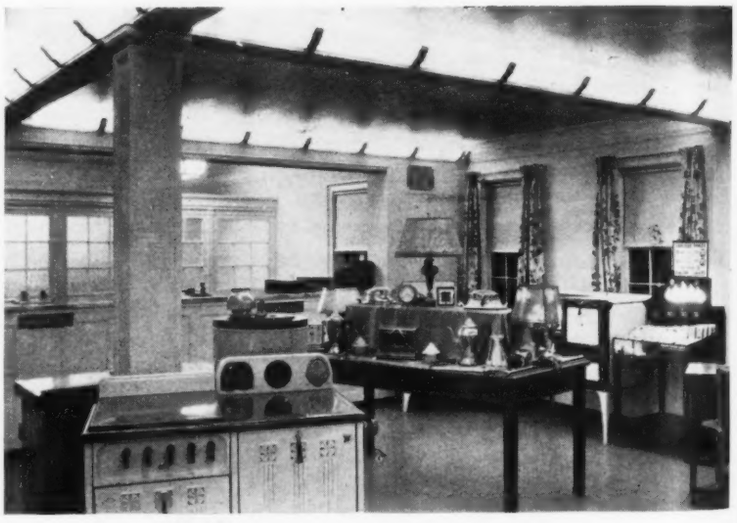
Home Background in a District Office

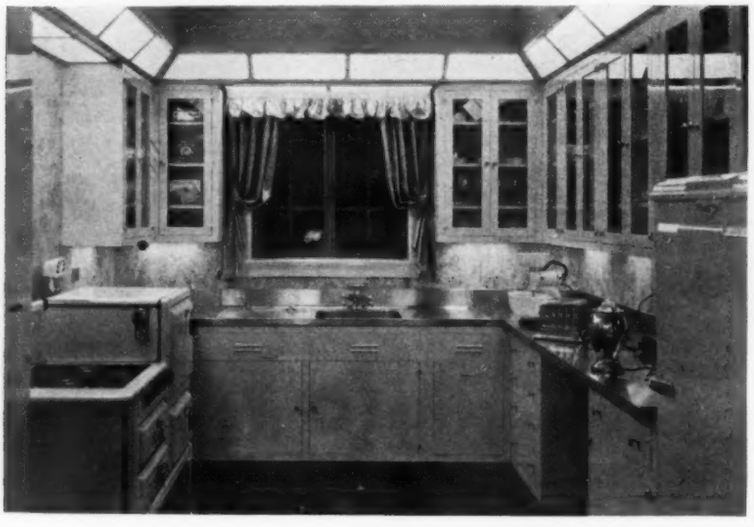
Jersey power company selects an old dwelling house and installs its appliance display in a residence setting.

Old Red Bank house remodeled by the Jersey Central Power & Light Company as a district show room and office, with the district manager's apartment on the floors above. Appliance displays are all located on the ground floor and include a model kitchen. Special illumination features give added interest.

THERE are many central stations operating in scattered towns which find it desirable to provide local or district offices in different communities. Very often an unoccupied store is chosen or, where a privately owned establishment seems desirable, a building is erected for this purpose. But it is difficult to transform the typical small store into something distinctive and attractive, and all too often the special building of brick or stone resembles a bank or public building and does not possess quite the right touch.

The Jersey Central Power & Light Company recently opened a new district office in Red Bank, N. J., which has unusual features. An old private home, built in the gay '90s, was remodeled to present a simple, colonial façade, dignified and inviting with its pure white finish and green shutters. There is no evidence of the commercial nature of the building save a sign on a post by the curb and the merchandise visible through the lower windows. A colorful stone walk flanked by grass plots and miniature shrubs leads to the low porch. By night five 100-watt reflector units, located behind the lintel, softly flood the façade. The lighted interior is visible through the windows and the larger pieces of merchandise are lighted from below by recessed prismatic plate units.





The interior has been changed very little. The forward part of the entire ground floor has been utilized as one large room where electric and gas appliances are displayed in a homelike atmosphere, with a customers' desk at the rear. The lighting was carefully studied to permit the high levels required at the present day and also to be in keeping with the general Colonial architecture. Due to the low ceiling, specially designed cove lighting was installed. Adjoining this on the south is a smaller display room where period furniture has been grouped around the old fireplace, from which a gas log casts out its cheery glow. Adjoining this is the model kitchen, a compact little room similar to that found in any small home, but so complete as to be

full of interest. In the rear is the commercial office.

These various elements combined make an extremely appealing and efficient establishment from the standpoint of operation and public appeal. The living quarters of the district manager are located on the upper floors. The building is air conditioned and presents many constructive lighting features. The entire commercial organization of the company co-operated in planning the building.

Canadian Streams Can Supply 43,700,000 Hp.

Water-power resources of Canada as at present recorded offer a potential turbine installation of about 43,700,000 hp., seven times the existing total of 7,322,070 hp., as of January 1, 1934. An announcement on the subject by the Dominion Water Power and Hydrometric Bureau lists these by provinces and presents a survey of current progress. Some of these statistics are abstracted in the accompanying tables.

The power estimates have been calculated on the basis of 24-hour power at 80 per cent efficiency for conditions of "ordinary minimum flow" and "ordinary six months flow." The former is based on the averages of the flows for the two lowest periods of seven consecutive days in each year, over the period for which records are available. The "ordinary six months flow" is based upon the continuous power indicated by the flow of the stream for six months in the year.

Analysis of plants concerning which complete data are available shows the average machine installation to be 30 per cent greater than the ordinary six months flow of power. It is on this basis that the total of potential installation has been computed.

Central electric stations account for the larger part, by far, of Canada's hydraulic installation. They constitute 87.0 per cent of the total. A considerable portion of the power generated by these installations is sold in bulk for the manufacture of pulp and paper, for the mining and reduction of minerals and for electrochemical production.

Available and Potential Water Power in Canada

January 1, 1934

Province	Available 24-Hour Power at 80% Efficiency (Hp.) At Ordinary Min. Flow	At Ordinary Six Mo. Flow	Turbine Installation (Hp.)
British Columbia	1,931,000	5,103,500	717,602
Alberta	390,000	1,049,500	71,597
Saskatchewan	542,000	1,082,000	42,035
Manitoba	3,309,000	5,344,500	390,925
Ontario	5,330,000	6,940,000	2,355,105
Quebec	8,459,000	13,064,000	3,493,320
New Brunswick	68,600	169,100	133,681
Nova Scotia	20,800	128,300	112,167
Prince Edward Island	3,000	5,300	2,439
Yukon and N. W. Territory	294,000	731,000	13,199
Canada	20,347,000	33,617,200	7,332,070

Water Power Installations by Industries

	Hp.
Central stations	6,380,691
Pulp and paper mills	600,996
Other industries	350,383
Total Canada	7,332,070
Installation per 1,000 population	686

Paper and pulp mills account for another 8.2 per cent of the total. In addition, pulp and paper mills have motor equipment for operation by hydro-electricity purchased from central stations, aggregating more than 1,031,000 hp.

Large amounts of hydro-electricity are also purchased for use in electric boilers to produce steam for heating of pulp cooking. During 1932 the hydro-electricity purchased by the industry totaled 5,759,795,132 kw.-hr., of which 2,695,075,726 kw.-hr., or more than 46¾ per cent, was used in electric boilers. The use of electric steam boilers has greatly increased recently.

Ferguson's Lamp Pricing Based on Uniform Discount

Asked why the Connecticut Power Company charges consumers for lamps rated below 60 watts in a recent debate in New London, Samuel Ferguson, chairman of the board, replied that the company makes a uniform discount from the list price of lamps of about one-third of a cent per kilowatt-hour used by the lamp during its life. "Since the life of lamps is approximately the same," he said, "obviously more kilowatt-hours are used during the life of a large than of a small lamp. It makes no difference whether a man uses eight 15-watt or three 40-watt lamps, totaling 120 watts in each case; he will get approximately the same discount in each case against the list price of the lamps. This credit will in each instance be respectively 40 and 36 cents. The slight difference in amount or credit is in favor of the smaller lamps, though, of course, the cost to the customer for eight lamps is more than for three.

"Since the manufacturers' list price is the same for all sizes under 60 watts, this credit will of course go further toward the cost of lamps if they are large than if they are small, and in the case of 60-watt lamps amounts to 100 per cent of the list price, but as far as the credit given is concerned it is exactly the same whether a man elects to use large or small lamps. In all cases it is about one-third of a cent per kilowatt-hour carried out to even figures.

"As a result it is cheaper for a man who wants 100 cp. to obtain it by the use of two 50 instead of four 25-watt lamps. In fact, he gains two ways, as the two 50-watt lamps give more light than the four 25-watt lamps on account of the higher efficiency of the larger lamps.

"It is desirable to give this discount on the price of lamps rather than on the price of electricity in order to control the quality of lamps used by the customers, since the markets are flooded with cheap foreign and domestic lamps which use anywhere from 40 to 200 per cent more energy than they should. In other cities, where customers are left to their own devices as to the purchase of lamps, they naturally fall for these cheap lamps, which look exactly like the good ones, but they suffer and the companies gain by the excess amount of energy used by the inferior lamps.

"It may be that under our policy occasionally a customer uses a larger lamp than is necessary, but for every such customer at least four others are saved from the use of inferior lamps which will consume double the energy for the same amount of light."

How Load Density Affects Distribution Costs

By B. E. ELLSWORTH
Iowa-Nebraska Light & Power Company, Lincoln, Neb.

MANY volumes have been written on distribution design, but a simple set of curves covering all or most of the important phases of this work is not often available. The object in the design of a distribution system is of course to serve a district of known load density in the most economical way, or at the lowest cost per kilowatt-hour delivered.

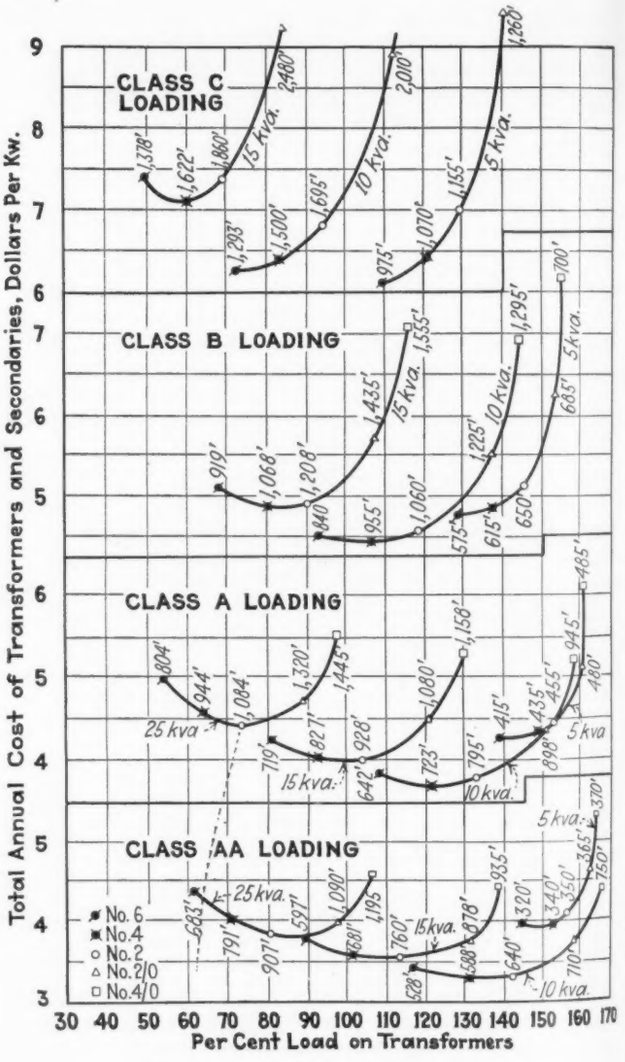
The four sets of curves shown here are for areas having load densities of 5, 10, 15 and 20 kw. per thousand feet of secondary run (peak load) which may consist of poor houses, average houses, best residential houses and rooming houses or apartment districts, respectively. These are designated as class C, B, A and AA loading.

These curves are based on the following assumptions:

1. The transformer is located at the center of a 110-220-volt secondary run, 1,000 ft. long.
2. Load is assumed to be concentrated at the ends of each secondary as we have found this meets actual conditions more closely than if the load were located at the center. It is also a more conservative assumption.
3. Load assumed to be at 90 per cent power factor.
4. Six per cent combined transformer and secondary regulation used (at peak loads).
5. 2,300/4,000 Y transformers are used for loss and regulation values.
6. Copper wire cost 15 cents per pound.
7. Value of power lost, 1 cent per kilowatt-hour.
8. Carrying charges on investment 15 per cent.
9. Load factor 40 per cent.

Example—Assume a distribution system in a class B district which is composed of average houses. From the class B curves the most economical secondary run will be found to be 955 ft. long using No. 4 copper wire with a 10-kva. transformer feeding it. The transformer loading with this arrangement would be 107 per cent.

If this same district builds up until it becomes a class A district, it will not be necessary to change the wire but merely to change the transformer to a 15 kva., as shown by the class A curves, with approximately the same secondary length, and economical operation will still be secured with 104 per cent transformer loading. The lengths of secondary runs will often depend upon the length of the blocks of the city in question. With these curves any conductor size, length of secondary and transformer size may be combined to suit the local conditions.



The spread of distribution costs

These four sets of curves show how annual costs of transformers and secondaries vary with load density. Each curve assumes a single transformer feeding both ways from the center of 1,000 ft. of secondary. Regulation is taken at 6 per cent and power factor at 90 per cent. Wire sizes are designated by symbol points on the curves. Loading classes are: AA, 20 kw. per 1,000 ft.; A, 15 kw.; B, 10 kw., and C, 15 kw., corresponding to the types of homes stated in the text of the article.

Informal opinions on present conditions and problems confronting the industry are helpful. We welcome to this forum the type of discussion presented by Mr. Conover and hope others will discuss industry questions here in a similar constructive vein.
—EDITORS.

A. W. Conover suggests—

Vice-President and General Manager
Oklahoma Utilities Company

Better leadership for utilities and the desirability of an industry co-ordinator

It occurs to me that we are confronted with making certain changes in the industry.* For years many public utility executives have maintained an attitude of complacency which makes it difficult for them to understand and compete with the conditions confronting our industry today. If we are to succeed and go forward certain changes in present-day practices are necessary. Obviously executive personnel should be closely analyzed.

The day is past when we as an industry can force our ideas upon the public. I am definitely of the opinion that the executives on operating properties, the men actually on the firing line, understand the transition which has taken place. However, their style is ofttimes cramped by the management to whom they report, who fail to understand the change which has developed in the past five years. The growth of our industry during the past decade has caused some of our real leaders to become so financial-minded that they have overlooked, and apparently forgotten, the problems of an operating property and just how badly we stand in the public mind today. To continue for another three or five years on this basis can be expected to bring only one answer to our industry.

Suggests a co-ordinator

Why would it not be advisable at this time, when we are endeavoring to work out a code of fair competition for a truly representative group of our industry, to meet with the executives of the federal government and have a co-ordinator appointed for the light and power business? Pick some outstanding American who has the respect of the nation and who would be acceptable to our government and to our industry. This individual should have an open mind toward all phases of the light and power business and the position it should take in the economic system of our country.

Certainly the railroads a few years ago found their plight similar to ours. The appointment of a co-ordinator saved their situation, and today our railroads are regaining their economic health and are generally considered in good condition. Their case is almost a parallel to ours. It should be possible for our industry to have a co-ordinator also. However, as I have stated, a truly representative group should develop this plan, and certainly the grass-root section of our country should be well represented in this proposed group.

Most of us will agree that there have been abuses in the public utility industry. However, no farmer destroys a barrel of apples because there happens to be a few rotten ones on the top. If the government is endeavoring to teach the public utility industry a lesson, it certainly does not accomplish its purpose by crucifying the small utility company, which has had a most difficult task remaining in business during recent years.

A St. Louis echo

You will recall that we endeavored to insert a clause of fair competition in the code prepared at the St. Louis conference in the early part of last December. This clause provided for a certificate of convenience to be issued the municipality requesting a municipal plant before it would be possible for it to go into business. If it were found impossible for the private company operating in any community to come to some understanding with the city administration, the city could then purchase its equipment and the company would realize something out of its investment. This seemed fair and just to all parties concerned. Certainly no property or investment would be destroyed and the principles of the American government would be followed.

When we arrived in Washington for our formal hearing last January this was entirely eliminated from our code, and we were advised that any such clause would not be given any consideration by the adminstrator, nor would it be permitted in the draft of our code. It is difficult for some of us to understand this attitude on the part of our government because we believe that we as business men should be given the same consideration as any other industry preparing a code. It is interesting to note that every code which I have had the opportunity to observe up until the present time has given the industry which it represents an opportunity to work out its problems and the right to live.

This is not so in our particular case, and it is time for all of us to be giving this situation serious thought. There are approximately 225,000 people employed in the light and power industry, and they are a representative group of citizens.

Leadership needed

Apparently we lack leadership to lead us out of the chaotic situation in which we find ourselves. Unquestionably some of the greatest business executives of our time are engaged in our industry, but for reasons best known to themselves they hesitate to lead us out of our predicament.

We should counsel with each other, and if it is impossible for us to get together on this situation as an industry throughout the nation, then we should endeavor to do so in our section of the country where we are threatened with confiscation.

*Based upon paper presented at Missouri Utilities Association, April 19, 1934.

Connection-Check by Lamp for Polyphase Meters

Various checks are available to verify the connections of low voltage polyphase meters which are so installed as to give plausible yet inaccurate readings. Some are intricate and time-consuming.

This simple—lamp, voltmeter, jumper—method has proved satisfactory for checking meters with current transformers but without voltage transformers.

By A. F. NEWMAN and M. MINIKES

Meter Department, New York & Queens Electric Light & Power Company

ON LOW-TENSION current transformer installations where the low operating voltage permits access directly to the current transformers a simple method of checking the polyphase meter connections has been devised. It is applicable to all load conditions and does not presuppose a knowledge of the load being used at the time of the test. In a previous article* the authors presented a method of checking polyphase meter connections by timing meter rotation under different current and voltage coil connections. This method was utilized principally on high-tension installations where both current and potential transformers were used with the watt-hour meter. The present method is simpler and applies to 400 volts or less. The advantages of this check are:

1. Meter wiring is not disturbed.
2. No ringing out of wiring necessary.
3. Minimum of equipment required; namely, a voltage indicator, 100-watt lamp, test socket with 15-ft. leads and a fused jumper.
4. Check can be made whether consumer's load is connected or not, and is independent of the load or power factor.
5. Knowledge of consumer's load not required.
6. No office computation or vector analysis necessary.
7. Consumer's load is not disturbed.

The underlying theory is as follows: Each element of the polyphase watt-hour meter is converted to a self-contained single-phase meter by connecting together, with a fused jumper, the line side of the current transformer primary winding and the secondary winding terminal of the same polarity. This is done at the current transformer. A non-inductive load (a lamp) is then connected directly between the load sides of the current and potential coils of the watt-hour meter. From the basic design of the single-phase meter forward rotation must result if the meter connections are correct.

The fused jumper may be provided with a clip on one end and a pin on the other. The end with the pin can then be inserted into the primary cable at the current transformer (as the primary connections are usually taped). The end with the clip can then be attached to the secondary winding terminal connection.

A test lamp of a voltage rating equal to the meter voltage may be used as the non-inductive load. A lamp is preferred to a rheostat, as the lamp brilliancy aids in determining loose connections or high resistance faults in the meter wiring.

Rotation behavior the criterion

If the meter is already rotating due to the consumer's load "forward rotation" will appear as "increased rotation," "no rotation" will appear as "no change in meter speed," "backward rotation" will appear as "decreased rotation." Since the test lamp is equivalent to approximately 20 per cent of the watt-hour meter rating when operating under this test its addition to the circuit, even under consumer's maximum load, is readily perceptible. The fused jumper connection converts the meter to a 5-amp., 100 or 200-volt, single-phase meter during the test. The test procedure is as follows.

Step 1—As the method presupposes that the secondary windings of the current transformers are not grounded, a check for ground is made at the start of the test (for each element) by checking the voltage between the line side of the primary winding and either secondary winding terminal of the current transformer under test. A voltage indication shows the secondary winding to be grounded. Zero voltage indicates no ground. If ground is found remove it before proceeding with test. The ground connection may be reinstalled, if desired, after the test is completed.

Step 2—Install fused jumper. Connect one end to the line side of the primary winding of the current transformer under test and the other end to its secondary winding terminal of the same polarity. This connection is made at the current transformer.

Step 3—To determine the meter element to which the current transformer with the fused jumper is connected check voltage between the load sides of the current and potential coils at each element of the meter. The element on which approximate meter voltage is obtained is the element connected to the current trans-

*"*Polyphase Meter Connections Checked by Timing Rotation,"* ELECTRICAL WORLD, *August 12, 1933.*

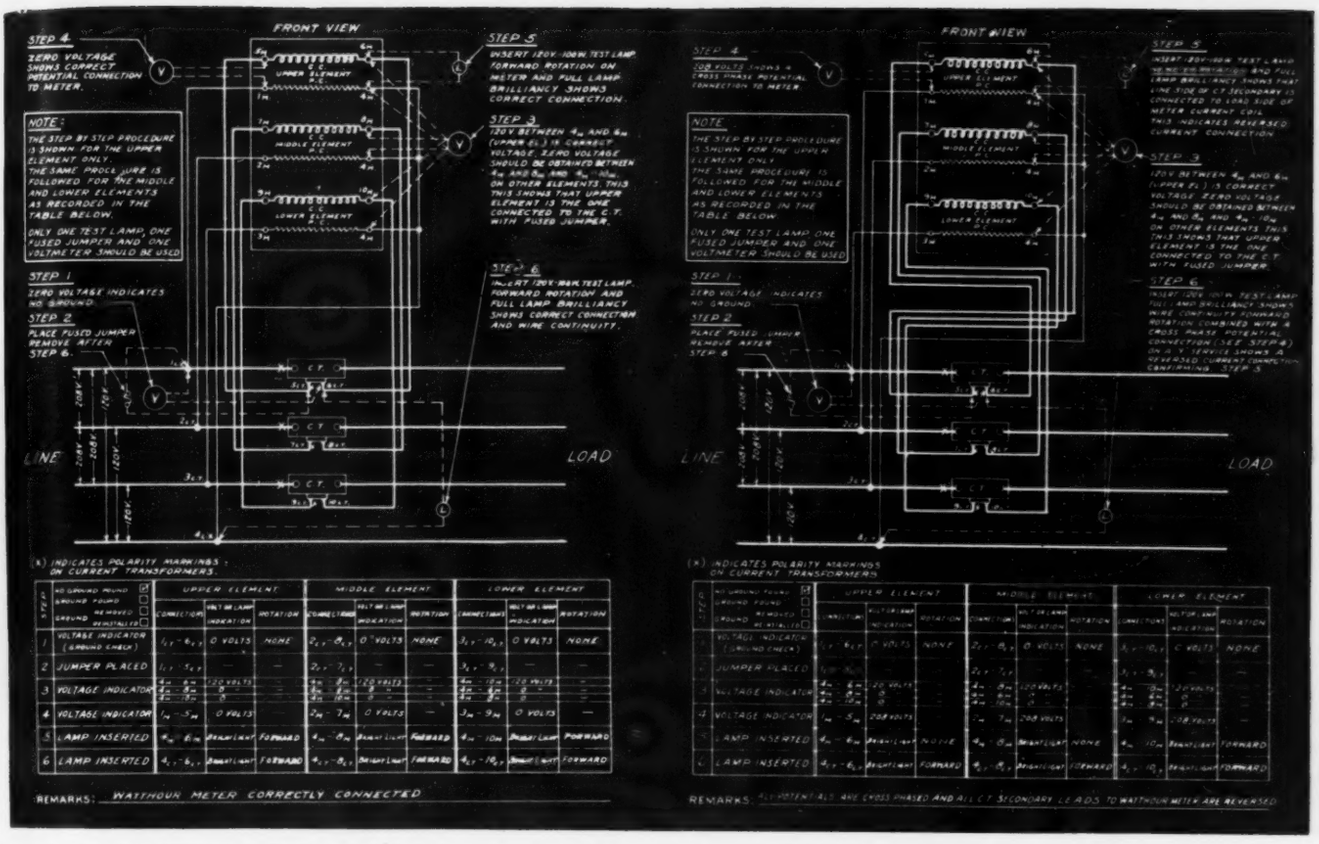

FRONT VIEW
STEP 4.
ZERO VOLTAGE SHOWS CORRECT POTENTIAL CONNECTION TO METER.
NOTE:
THE STEP BY STEP PROCEDURE IS SHOWN FOR THE UPPER ELEMENT ONLY. THE SAME PROCEDURE IS FOLLOWED FOR THE MIDDLE AND LOWER ELEMENTS AS RECORDED IN THE TABLE BELOW.
ONLY ONE TEST LAMP, ONE FUSED JUMPER AND ONE VOLTMETER SHOULD BE USED.
STEP 1.
ZERO VOLTAGE INDICATES NO GROUND.
STEP 2.
PLACE FUSED JUMPER REMOVE AFTER STEP 6.
STEP 5.
INSERT 120V-100W TEST LAMP. FORWARD ROTATION ON METER AND FULL LAMP BRILLIANCY SHOWS CORRECT CONNECTION.
STEP 3.
120V BETWEEN 4m AND 6m (UPPER EL.) IS CORRECT VOLTAGE. ZERO VOLTAGE SHOULD BE OBTAINED BETWEEN 4m AND 8m AND 4m - 10m ON OTHER ELEMENTS. THIS SHOWS THAT UPPER ELEMENT IS THE ONE CONNECTED TO THE C.T. WITH FUSED JUMPER.
STEP 6.
INSERT 120V-100W TEST LAMP. FORWARD ROTATION AND FULL LAMP BRILLIANCY SHOWS CORRECT CONNECTION AND WIRE CONTINUITY.
LINE
LOAD
(x) INDICATES POLARITY MARKINGS ON CURRENT TRANSFORMERS.
REMARKS: WATTHOUR METER CORRECTLY CONNECTED
FRONT VIEW
STEP 4.
208 VOLTS SHOWS A CROSS PHASE POTENTIAL CONNECTION TO METER.
NOTE
THE STEP BY STEP PROCEDURE IS SHOWN FOR THE UPPER ELEMENT ONLY. THE SAME PROCEDURE IS FOLLOWED FOR THE MIDDLE AND LOWER ELEMENTS AS RECORDED IN THE TABLE BELOW.
ONLY ONE TEST LAMP, ONE FUSED JUMPER AND ONE VOLTMETER SHOULD BE USED.
STEP 1.
ZERO VOLTAGE INDICATES NO GROUND.
STEP 2.
PLACE FUSED JUMPER REMOVE AFTER STEP 6
STEP 5.
INSERT 120V-100W TEST LAMP. FULL LAMP BRILLIANCY SHOWS THAT LINE SIDE OF C.T. SECONDARY IS CONNECTED TO LOAD SIDE OF METER CURRENT COIL. THIS INDICATES REVERSED CURRENT CONNECTION.
STEP 3.
120V BETWEEN 4m AND 6m (UPPER EL.) IS CORRECT VOLTAGE. ZERO VOLTAGE SHOULD BE OBTAINED BETWEEN 4m AND 8m AND 4m - 10m ON OTHER ELEMENTS. THIS SHOWS THAT UPPER ELEMENT IS THE ONE CONNECTED TO THE C.T. WITH FUSED JUMPER.
STEP 6.
INSERT 120V-100W TEST LAMP. FULL LAMP BRILLIANCY SHOWS WIRE CONTINUITY. FORWARD ROTATION COMBINED WITH A CROSS PHASE POTENTIAL CONNECTION (SEE STEP 4) ON A 'Y' SERVICE SHOWS A REVERSED CURRENT CONNECTION CONFIRMING STEP 5.
LINE
LOAD
(x) INDICATES POLARITY MARKINGS ON CURRENT TRANSFORMERS.
REMARKS: ALL POTENTIALS ARE CROSS PHASED AND ALL C.T. SECONDARY LEADS TO WATTHOUR METER ARE REVERSED

Fig. 1—Three-element, 120-volt meter checked for connections to four-wire, three-phase, 120/208-volt service

Left—Connections prove correct. Right—Potentials demonstrated to be cross-phased and current leads reversed.

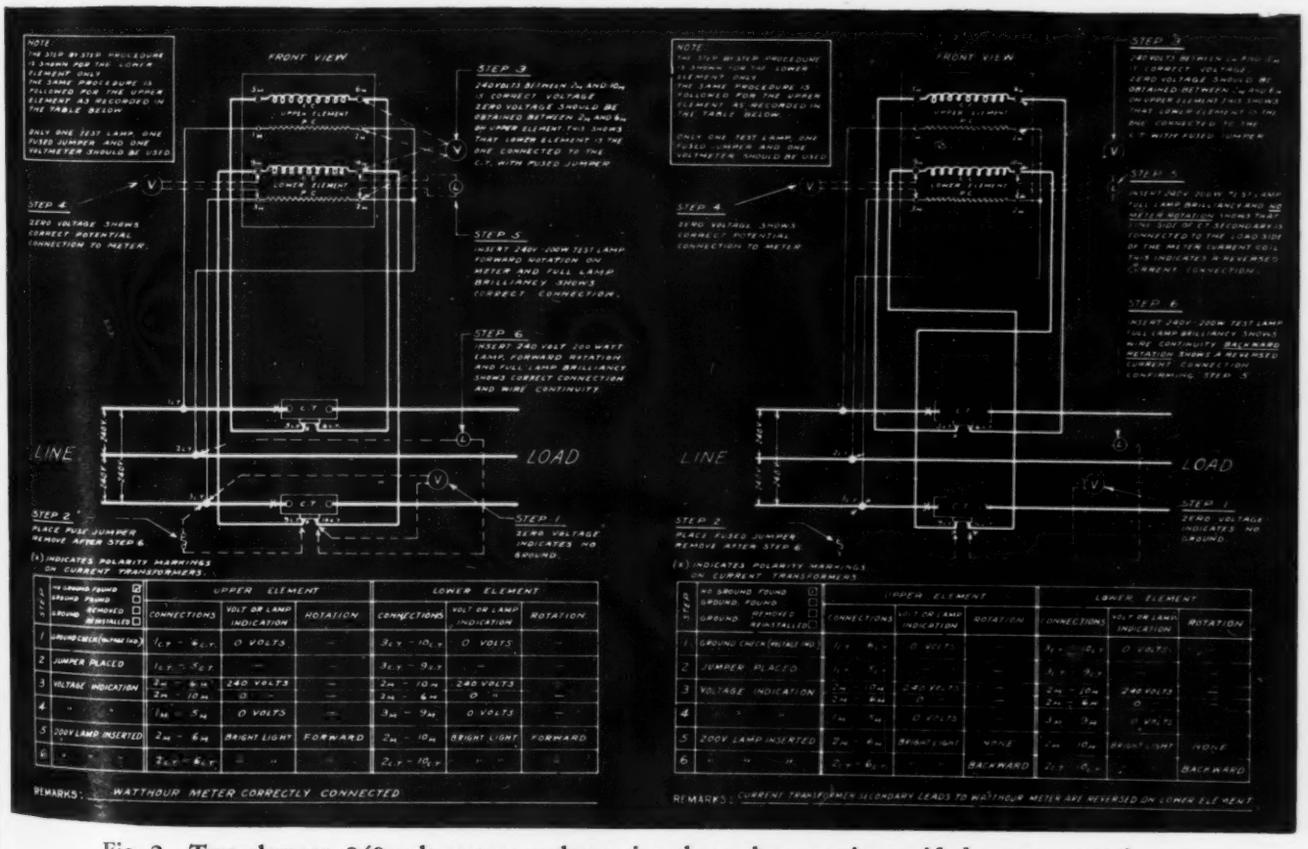

FRONT VIEW
NOTE
THE STEP BY STEP PROCEDURE IS SHOWN FOR THE LOWER ELEMENT ONLY. THE SAME PROCEDURE IS FOLLOWED FOR THE UPPER ELEMENT, AS RECORDED IN THE TABLE BELOW.
ONLY ONE TEST LAMP, ONE FUSED JUMPER AND ONE VOLTMETER SHOULD BE USED.
STEP 4.
ZERO VOLTAGE SHOWS CORRECT POTENTIAL CONNECTION TO METER.
STEP 3.
240 VOLTS BETWEEN 2m AND 10m IS CORRECT VOLTAGE. ZERO VOLTAGE SHOULD BE OBTAINED BETWEEN 2m AND 8m OR UPPER ELEMENT. THIS SHOWS THAT LOWER ELEMENT IS THE ONE CONNECTED TO THE C.T. WITH FUSED JUMPER.
STEP 5.
INSERT 240V-100W TEST LAMP. FORWARD ROTATION ON METER AND FULL LAMP BRILLIANCY SHOWS CORRECT CONNECTION.
STEP 6.
INSERT 240 VOLT 200 WATT LAMP. FORWARD ROTATION AND FULL LAMP BRILLIANCY SHOWS CORRECT CONNECTION AND WIRE CONTINUITY.
LINE
LOAD
STEP 2.
PLACE FUSE JUMPER REMOVE AFTER STEP 6.
STEP 1.
ZERO VOLTAGE INDICATES NO GROUND.
(x) INDICATES POLARITY MARKINGS ON CURRENT TRANSFORMERS.
REMARKS: WATTHOUR METER CORRECTLY CONNECTED
FRONT VIEW
NOTE
THE STEP BY STEP PROCEDURE IS SHOWN FOR THE LOWER ELEMENT ONLY. THE SAME PROCEDURE IS FOLLOWED FOR THE UPPER ELEMENT, AS RECORDED IN THE TABLE BELOW.
ONLY ONE TEST LAMP, ONE FUSED JUMPER AND ONE VOLTMETER SHOULD BE USED.
STEP 4.
ZERO VOLTAGE SHOWS CORRECT POTENTIAL CONNECTION TO METER.
STEP 3.
240 VOLTS BETWEEN 2m AND 10m IS CORRECT VOLTAGE. ZERO VOLTAGE SHOULD BE OBTAINED BETWEEN 2m AND 8m OR UPPER ELEMENT. THIS SHOWS THAT LOWER ELEMENT IS THE ONE CONNECTED TO THE C.T. WITH FUSED JUMPER.
STEP 5.
INSERT 240V-100W TEST LAMP. FULL LAMP BRILLIANCY AND NO METER ROTATION SHOWS THAT LINE SIDE OF C.T. SECONDARY IS CONNECTED TO THE LOAD SIDE OF THE METER CURRENT COIL. THIS INDICATES A REVERSED CURRENT CONNECTION.
STEP 6.
INSERT 240V-200W TEST LAMP. FULL LAMP BRILLIANCY SHOWS WIRE CONTINUITY. BACKWARD ROTATION SHOWS A REVERSED CURRENT CONNECTION CONFIRMING STEP 5.
LINE
LOAD
STEP 2.
PLACE FUSED JUMPER REMOVE AFTER STEP 6.
STEP 1.
ZERO VOLTAGE INDICATES NO GROUND.
(x) INDICATES POLARITY MARKINGS ON CURRENT TRANSFORMERS.
REMARKS: CURRENT TRANSFORMER SECONDARY LEADS TO WATTHOUR METER ARE REVERSED ON LOWER ELEMENT

Fig. 2—Two-element, 240-volt meter on three-wire, three-phase service verified as to connections

Left—Correctly connected. Right—One element has current connections reversed.

former under test. Zero voltage should be obtained on the other elements. A voltage other than approximate rated meter voltage on the element tested shows an incorrect or faulty connection.

NOTE—Normal voltage obtained on the other elements during this step indicates the possibility that the secondary windings are tied together. If this condition exists Step 3 is altered as follows:

Alternate Step 3—Connect lamp of proper voltage between the common secondary current connection and the unmetered service wire. Rotation should result. Open each current switch in turn until rotation stops. The element on which rotation stops is the one connected to the current transformer under test. Reclose all switches and proceed with Step 4.

Step 4—Connect the voltage indicator between the current and voltage coil terminals on the line side of the watt-hour meter on the element under test. Zero voltage shows correct connection to this point. A voltage other than zero indicates a cross phase potential connection.

Step 5—Connect the test lamp between the current and voltage coil terminals on the load side of the watt-hour meter on the element under test. Forward rotation of the meter and full lamp brilliancy shows correct connection to this point.

Step 6—Connect the test lamp between the unmetered service wire and the current transformer secondary terminal which does not have the fused jumper connected to it. The unmetered service wire is the one to which the common potential tap is connected. This connection is made at the current transformer under test. Forward rotation shows correct connection. Full lamp brilliancy shows wire continuity.

A meter to be connected correctly must give correct results for all steps. Remove fused jumper after Step 6.

Proceed in the same manner to test the other elements of the watt-hour meter.

Field operations required in logical step-by-step procedure for checking the connections of a three-element, 120-volt meter correctly connected to a 120/208-volt, four-wire, three-phase circuit are shown in Fig. 1 (left). In the case shown at right, the meter is connected with all potentials to the meter cross-phased and all current transformer secondary connections reversed at the meter. This incorrect connection shows forward rotation on all meter elements when each element is checked separately on the consumer's load.

A check on a two-element, 240-volt meter correctly connected to a three-wire, three-phase, 240-volt circuit is shown in Fig. 2 (left) and at right a check on same meter shows it to be connected with the current transformer secondary winding reversed at the lower element of the meter. This connection would show forward rotation on this element if checked separately on the consumer's load, provided the reversed connection was on the slow or lagging element and the consumer's load was below 50 per cent power factor (inductive).

Charts Aid Control of Hydro Economy

By H. A. VON EIFF and C. W. WATCHORN
Pennsylvania Water & Power Company

Where several hydro plants operate on a single river, the working out of the over-all economies becomes a complicated process. Hydro engineers will be interested in this system on the Susquehanna River, where excellent results have been secured by this method of control charts.

INITIAL operation of the Holtwood hydro plant* of the Pennsylvania Water & Power Company began in the fall of 1910. The last two units of a total of ten were put in service in the spring of 1924. The first five units were installed in rapid succession in 1910 and 1911, the sixth and seventh in 1912 and 1913, respectively, and the eighth in 1914. These units were of four separate designs and operating characteristics. There are now ten units in service in this plant, all being three-phase machines, of which the first eight are 25 cycle and the last two 60 cycle. Of the eight 25-cycle units the first seven are double-runner machines and the eighth a single-runner machine. The first five of the double-runner machines are of the same design, while the last two are of a different design. The 60-cycle units are of the same design and are both single-runner machines. Two frequency changers of a combined capacity about equal to that of one of these latter units were installed at about the same time.

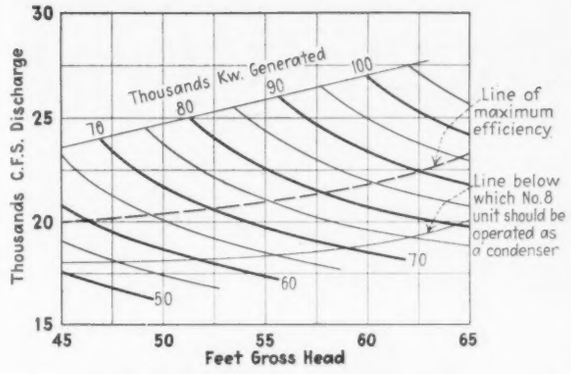
The plant is on the Susquehanna River, the flow of which varies through a very wide range from many times more than the plant discharge to approximately a tenth of the discharge, and consequently is operated as a run-of-river plant. The difficulty of operating such a plant for the maximum output from the water available during low flow periods will be readily appreciated.

Very early in the history of the plant it was found desirable to have some measure of the operating results. This measure was called the operating index and was determined as the ratio of the actual operating results to the best experience obtained under similar conditions of river flow. Both of these were expressed in terms of the ratio of the daily energy generated to the water discharged through the units; i.e., in kw. per c.f.s., which was called the "kilowatt equivalent." This worked very well for a number of years until the Philadelphia Electric Company constructed the Conowingo plant, about 15 miles down the river, and further proved to be less adequate for our needs after the Safe Harbor plant was put in service.

These plants and other influences produce a complicated combined effect upon the economy of operation and have tended to render the use of "standard kilowatt equivalents" somewhat unsatisfactory as a measure of plant performance. It was finally decided to make up plant performance curves for various heads for various numbers and combinations of units, the combinations being limited to those considered to be practical under various conditions of loading and availability of units.

The same incremental or differential loading basis was used in making up these loading curves as that used in the earlier investigation of many years ago. This had resulted in establishing the principle that, in general, for best economy the units operated should carry such loads that their respective incremental efficiencies would be

*Based upon paper presented at meeting of hydraulic power committee of Pennsylvania Electric Association, Washington, April 25, 1934.


Thousands C.F.S. Discharge
Feet Gross Head
Thousands Kw. Generated
Line of maximum efficiency
Line below which No. 8 unit should be operated as a condenser

Combined performance curves for eight 25-cycle units at Holtwood

equal, which simply means that the same additional amount of water would be required by each of the units operated to generate an additional equal small amount of power.

The accompanying chart shows the plant performance curve for the eight 25-cycle units and is typical and illustrative of the curves now being developed for other combinations. These curves give the plant discharge as a function of the head for various values of generation. The curves also show the generation for maximum efficiency for various heads and also the load for which No. 8 unit, which is equipped to be operated as a synchronous condenser, should be so operated. It is expected that these last two features will be a very valuable guide to the operators.

Operating efficiency checked by chart

The following example illustrates the use made of these charts: Assume that the head is 50 ft., the actual generation 57,500 kw. and the discharge computed from the operation is 18,200 c.f.s. Then with this head and discharge we find that we should expect a generation of 58,000 kw., or 500 kw. more than the actual, which is a loss of 0.86 per cent because of inefficient loading of the units. It is quite evident that closer supervision might result in more efficient operation.

If we now use the similar chart for one less unit or, in some cases, one more unit, we can determine if the most economical number of units were operated, and if the most economical number of units were not operated what the results would have been if the most economical number of units had actually been operated. Then, going into the performance curves with the above head and discharge for the correct combination and number of units so determined, which in this case is for one less of the more inefficient units, we find we could have generated 59,000 kw. This means that we have suffered a loss of 1,000 kw., or 1.69 per cent because of operating more units than really necessary to carry the load. It might be that the larger number of units are really necessary because of more spare capacity being required than would be available with the smaller number of units, in which case we have a means of evaluating the cost of the hydro spare capacity, but it might also be that the larger number of units were not really required to be operated but were operated rather because of inattention on the part of the operators. If this latter be the case, the results thus obtained would call the fact to the operator's attention and he could then proceed to take the proper corrective steps.

Results obtained from the operation of three different actual days for which no hour-to-hour control of the results, as herein described, was used, are shown by the following tabulation:

	Daily Basis			
	Loss from Inefficient Operation		Loss from Spare Capacity Carried	
Day	Kw.-Hr.	Per Cent	Kw.-Hr.	Per Cent
First	10.7	0.68	9.5	0.60
Second	9.7	0.76	9.0	0.70
Third	9.4	0.81	29.4	2.48

As mentioned above, another use which we expect to make of these charts is that they be used as a guide to the operators as to when No. 8 unit should be operated as a condenser. Let us assume that the load and the spare capacity required to be carried call for eight 25-cycle units to be operated as shown in the accompanying illustration, but the load to be carried is such that it is less than that indicated by the line below which No. 8 unit should be operated as a condenser. From this performance chart we find that for a 50-ft. head and 51,000 kw, the discharge would be 16,400 c.f.s. If No. 8 unit were operated as a condenser the units actually carrying load would be those shown in the chart less No. 8 unit. Then, from the proper chart we find for the above head and discharge that the generation would be 52,200 kw. but as No. 8 unit takes 600 kw. when operated as a condenser, the net would be 51,600 kw., or a gain of 600 kw. or 1.16 per cent over that for the same units all operated carrying load. If no spare capacity were required, the load could actually be carried by two units less than for which the chart was made. This would be the chart for which two of the less efficient units would be shut down, from which for this above head and discharge we get 53,100 kw. This means that the spare required to be carried causes a loss of 1,500 kw., or 2.83 per cent.

It is believed that this method of having the operators check their operation hourly will give us a very desirable control of the efficiency of operation and will result in a material increase in the low flow plant output. It is also intended to use this same method in exercising control of the low flow operation of the Safe Harbor plant.

Thrifty Maintenance Pays; Here's How and Why

Operating staffs are still looking for ways to escape the hang-over extravagances of a lush era. Here are a few that Northwest properties have used to save a long-range dollar.

Trimming is as useful in connection with administrative practice as with the trees that hamper distribution. Some new maintenance practices developed by companies in the Northwest have been summarized by M. T. Crawford, general superintendent of the Puget Sound Power & Light Company, in this manner:

If live line insulator testing is done thoroughly and defective insulators are replaced and weakened structures adequately strengthened transmission lines may give more reliable service with much less frequent patrolling. The total cost of maintenance and operation for the year may be reduced.

Cost of replacing one insulator under emergency conditions after failure and service interruption will pay for the testing and replacement work on a considerable length of line.

Emergency repairs, line outage and possible damage claims

attending one pole broken off in service will pay for a large amount of pole inspection and stubbing.

Stubbing bands in place of wire for attaching stubs has proved more economical in some instances. The cost of doing the work is approximately the same either way, but the stubbing bands can be salvaged and used again, whereas the wire cannot.

One company has stopped all tree trimming in residence districts and for three years has been using tree wire exclusively. A grounded neutral 4-kv. primary with single-phase feeders in residence areas made it necessary to protect only one primary wire if the secondary insulation was in good condition. A good quality tree wire of moderate size can be installed for 10 to 12 cents per foot; a 25-ft. length costs about the same as trimming for three years (either by tree expert organizations or by company crews), but the tree wire should last fifteen years or more.

Another company uses a caterpillar tractor and winch to uproot trees and clumps of moderate size along rights-of-way. Piling and burning the rubbish leaves the terrain in good condition for several years without further trimming. Labor cost is about the same as using the axe; tractor cost was additional and probably only justifiable where soil is soft and trees are not too large.

Careful study of primary junction boxes on underground feeders revealed they were the cause of as much trouble as they prevented. By substituting splices emergency repairs were avoided.

A substantial saving was made by one company which reconditioned transformer oil. The chemist at the steam plant laboratory neutralized the acidity in the old oil by soda ash treatment and, after drying and filtering, found that it tested as good as new oil.

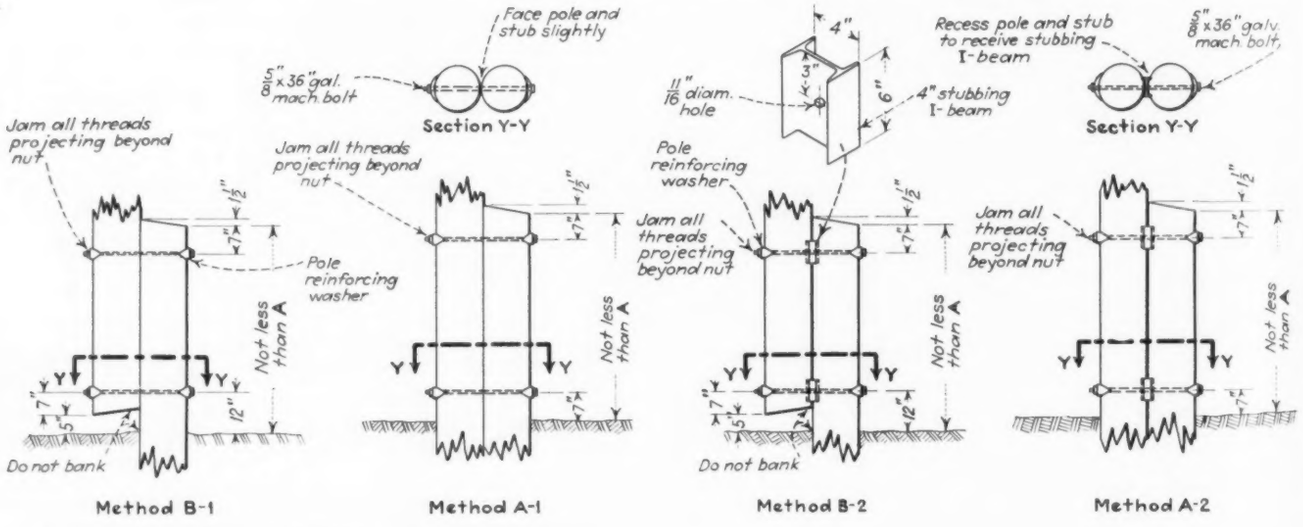
POWER COMPANY

Portable Ground Locater Aids Rural Line Servicing

By W. F. SOMERS
Iowa Public Service Company, Waterloo

If a good water-pipe neutral ground is made on a customer's premises, then a service entrance or branch line fuse can be depended on to blow when an outside wire is accidentally grounded. But not all the wiring installations in the country conform to the National Electrical Safety Code in this respect and there are many, particularly in smaller communities, in which an outside wire, possibly overfused or even properly fused, becomes a source of danger by accidental grounding. Such a condition may continue for a considerable time if the

New Wood, Brush-Treated, Should Be Used for Stubs



Length of Pole	A	Min Total Length of Stub	Min. Diam. of Stub
30 ft.	5 ft.	10 ft.	8 in.
35 ft	5 ft.	10 ft. 6 in.	9 in.
40 ft.	5ft. 6 in.	11 ft. 6 in.	10 in.
45 ft.	6 ft.	12 ft. 6 in.	11 in.
50 ft	6 ft.	13 ft.	12½ in.

Stubbing at the side and in-line

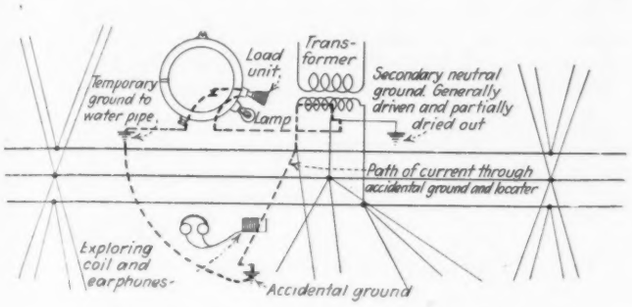
At left are shown two methods as applied to side reinforcement and at right to stubbing in-line with the lead. The same values of stub length and of dimension "A," extension above the ground line, apply in both cases.

Sound new chestnut or cedar stubs, brush-treated their full lengths, are required for reinforcing poles located in alleys and in rural territories, according to the field construction drawings for distribution lines of the West Penn Electric Company. The only difference between side and in-line stubbing is the use of a couple of I-beam sections between stub and pole in the latter case.

Both applications have two variations, methods A and B, as shown in the accompanying sketches. In method A a new hole is dug for the stub alongside the pole and the stub laid up close without any banking. In B the pole is cut off just above the ground line, the old butt dug out and the stub dropped into its place. All soft and decayed wood and outside brittle layers of sapwood are removed from the pole butt where it will clamp against the stub.

Care is taken that rotted wood and loose earth around the decayed pole butt are not used for filling in around the stub. This is to guard against infecting the new wood of the stub.

neutral ground at the transformer—driven rods and frequently pretty thoroughly dried out—is of abnormally high resistance. Sometimes a secondary conductor becomes actually hot while the customer on whose premises the ground exists is blithely unaware of the condition. In districts where it is known that transformer and wiring installations have poor or no neutral grounds it is wise to watch the secondary current balance closely and to test for outside wire grounds when one conductor appears to be carrying an extraordinary load.


Load unit
Trans-former
Temporary ground to water pipe
Lamp
Secondary neutral ground. Generally driven and partially dried out
Path of current through accidental ground and locater
Exploring coil and earphones
Accidental ground

Secondary grounds located quickly

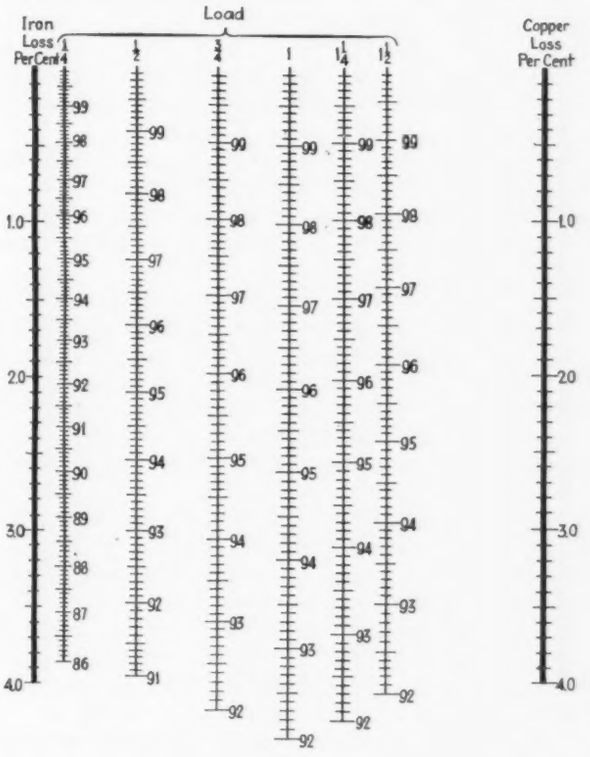
The test device imposes an intermittent load on the return circuit formed by the accidental ground. The response of this load will be heard as a recurring sound only on the secondary conductor and service lead affected. There may be a normal load on the conductor, which will be heard as a continuous hum, with the test load sounding at regular intervals above it.

Such testing is done on the Waterloo system of the Iowa Public Service Company with a portable secondary ground locater that was assembled from old meter and other parts and the cost of which to build amounted to very little.

The locater consists of a device which puts periodically recurring load in the ground circuit at the distribution transformer and an exploring coil with ear phones by which the service drop lead on which the accidental ground exists is identified. In an old General Electric demand meter case is mounted a voltmeter clock which drives a disk, salvaged from a watt-hour meter, the edge of which is coarsely saw-toothed so that as it revolves it makes and breaks a single dry cell circuit by means of a set of demand meter contacts. In the battery circuit is a relay that used to be in a radio trickle charger and which controls the test load circuit. In this circuit are a red lamp and a 600-watt radiant heater unit connected in parallel. All of these gadgets are packed inside the demand meter case. The exploring coil is an old potential coil that was taken from an I-10 meter and which, for the purpose, is more sensitive than commercial devices of this kind.

Reference to the accompanying diagram makes clear how the outfit works. The lineman hangs it on the transformer pole, screws the heating unit and the red lamp into the sockets supplied for them on the outside of the case, connects the test circuit between the transformer neutral and a water pipe or other ground that he knows is good and starts the clock going. Then if there are any grounds on the secondary and if the transformer neutral ground is not what it should be he sees the lamp light and go out and light again as the contact mechanism and relay operate. With the exploring coil he readily identifies the grounded secondary because the comparatively heavy load of the heating unit puts a healthy punch into the response of the exploring coil. If he gets no response on the secondary lines either way from the transformer pole he knows that the ground is in one of the houses connected to that pole. It is an easy matter then to find the particular service drop wire that is grounded. And when the customer is informed that his meter is registering a lot of current that is not being used it is not long before the ground is cleared. It is obvious, of course, that this method finds its simplest application on secondaries supplied from a single transformer.

Transformer Efficiencies Readily Determined



Ready determination of transformer efficiencies from loss data is possible by means of a chart presented in the No. 1 (1934) issue of *A.E.G. Progress.* It is worth while remembering in using it that per cent copper loss is identical with per cent voltage drop at normal output and unity power factor; also, that if loss is in watts the per cent value is found by multiplying by 100 and dividing by 1,000 times the kva.

For other power factors the efficiency is found by increasing the values of iron and copper loss "in the same ratio as that existing between unity p.f. and the pertaining p.f. and plotting these values on the left and right hand scales."

LETTERS TO THE EDITOR

One Breaker Enough for Two or More Feeders?

To the Editor of the ELECTRICAL WORLD:

An article in ELECTRICAL WORLD of March 31, 1934, page 464, by L. F. Woodruff and J. E. Mulligan, entitled "Transfer Feeder Faults to One Breaker," recommends a fault transfer switch and a proposed diagram of connections which are to secure a reduction of switching equipment in important stations of large power companies.

When considering proposals of this kind it is important that the nature and extent of the task assigned to the equipment should be clearly in mind. It should be recalled that in "important stations" of "large power companies" the main bus sections are supplied from 50,000 to 100,000 kva. or more of generating capacity and, commonly, heavy capacity ties to other sources. The bus voltages are of the order of 10 to 30 kv. and the interrupting ratings of the main protective breakers range from 1,000,000 to 2,500,000 kva., with correspondingly heavy currents and mechanical stresses.

The proposed scheme and equipment are not practical for such applications and have been eliminated from consideration along with many similar schemes. The more important reasons for their elimination may be stated briefly as follows:

Protection to Feeders—The minimum time required to clear feeder fault with present standard equipment is in the order of 0.20 second, or 12 cycles (60-cycle system). For the proposed arrangement it would probably be in the order of 0.60 second, or 36 cycles. Due regard for feeder cable investment and system stability would suggest a decrease, rather than a 200 per cent increase, in the time the fault is permitted to extend the damage. An editorial on page 462 of the same issue of the ELECTRICAL WORLD states "speeds of opening have been cut from 25 to 35 cycles to 8 cycles and 3- or 4-cycle breakers are on the horizon."

Faults on companion feeders may occur while the first is in process of clearing, in which event a second fault might clear in a minimum time of 1.0 second, or 60 cycles, etc.

Protection to Station Capacity—Connection of the feeder bus solid to the main bus constitutes an excessive extension of the main bus, possibly 200 to 1,000 per cent or more, depending upon the layout, with the attendant enormously increased risk of loss of the entire main bus section.

Protection to System Regulation—Would be decreased proportionately as the time of clearing faults is increased and as the footage of unprotected circuit connected to the main bus is increased.

Protection to Personnel—Requires that such equipment and its connections and associated devices be installed in inclosed compartments such as masonry, metal or equivalent, or that it be space-isolated, which is usually impracticable. Experience with the installation, the maintenance and the safety considerations of air-insulated automatic protective equipment for important high-voltage, heavy-duty applications has practically vetoed its use. Protection to personnel is one of the major factors in the present use of oil-insulated circuit breakers and metal-clad or inclosed equipment.

Cost—The fault transfer switch illustrated in the article has a stated current rating of 100 amp. The voltage rating for the type of design would be perhaps not over 600 volts. Visualize the switch designed for a 13.2-kv. system, with a rating of 600 or 1,000 amp. at 15 kv., a test voltage of 30 to 40 kv. The requirements of adequate and dependable design as regards installation, mechanical strength and electrical and mechanical operation would approach, if not equal, that of the main group breaker. Add the necessary isolating switches for each feeder and an additional set between feeder bus and main bus; also an additional stub (feeder) bus with its connections, all built to main bus specifications; also an additional extensive and complicated control wiring system, extra relays and auxiliary switches, and it should be apparent that the proposed group arrangement would be more costly than three full capacity breakers with self-contained disconnects and auxiliaries.

C. H. SANDERSON.

New York Edison Company,
United Electric Light & Power Company.

British Protect Cables Against Sheath Corrosion

To the Editor of the ELECTRICAL WORLD:

David Williams, in his letter on page 485 of the ELECTRICAL WORLD for March 31, 1934, does not make any mention of defects due to corrosion, and from the number of interested people in the U.S.A. who have written my firm in reference to a letter on the same subject that appeared in your issue of November 4, 1933, there must be a considerable amount of trouble from corrosion in your country.

It has been the experience in this country, also, that such defects are by no means uncommon, especially when cables are laid in corrosive soil.

Protective coatings over the lead sheath can only be effective if they prevent moisture from reaching the sheath, and it has been proved both by experience and from tests that the commonly used method of applying compounded servings is not satisfactory in this respect. My company, therefore, introduced in 1928 "Pernax" sheathing as a protection to the lead. Since this date many thousands of yards of cable have been treated for use under conditions of the utmost severity, and in no instance has any defect developed.

In one particular case a 6,600-volt "Pernax" sheathed cable laid across a sewage farm has been in use for more than two years, having replaced three other types of cables which lasted respectively three, five and six months, though specially protected by the best of the usual compounded methods.

There is thus ample evidence that "Pernax" sheathing is entirely effective as a protection against corrosive troubles, and if any of your readers desire further information I shall be happy to reply to inquiries.

H. R. ALLEN,
Works Manager.

Croydon Cable Works, Ltd.,
Croydon, England.

NEWS OF THE WEEK

Scope of National Power Inquiry Set

Nation-wide power survey and rate investigation to be combined. Government officials reach agreement with utilities on conduct of probe. Methods to be pursued are outlined by Manly.

An agreement has been reached on the scope of the proposed federal survey of national power resources and investigation of light and power rates. Following conferences between federal, state and municipal officials and representatives of utility interests, the Federal Power Commission after eight months is ready to decide upon the final plans for the investigation, Commissioner Basil Manly announced this week.

"As a result of this preliminary study," Mr. Manly states, "the survey naturally resolves itself into finding the answers to two great problems: (1) What are the present and future power requirements of the continental United States? (2) From what sources can these power requirements be supplied most economically and efficiently in the public interest?

Unneeded sources eliminated—"This method of approach eliminates from consideration the very numerous power sites for which there is no requirement either because of their distance from a possible market or because the cost of generation is excessively high. It further concentrates attention upon those sections in which prospective demands exceed the power sources now existing or in process of development.

"In our determination of the nation's power requirements it is necessary not only to view the present but also to look into the future. By present power requirements we mean not the consumption of electricity during the depression but what will be needed when the industries of the country resume normal operation and when domestic and rural consumers have regained their normal purchasing power.

"As to the methods to be pursued in conducting both the survey and the inquiry, it is obvious that a very large part of the information must be secured either by utilizing existing published and unpublished studies or by the use of questionnaires. This means that to be successful the survey must have the wholehearted co-operation not only of governmental agencies but also of the executives of privately and publicly operated utilities."

The agreement reached in the conferences with representatives of public and privately owned light and power interests held that the rate and power survey is timely and should be of interest not only to consumers but also to executives of utilities concerned with the "future economic development of the nation's power resources." It further agreed that both investigations "should be directed toward an accurate determination of all pertinent and essential facts regarding the power industry in every section of the country." The co-operation of utilities in the survey was expressed in that part of the agreement reading: "That the books, records and special studies of both public agencies and private companies should be open to inspection by the agents of the commission and that full co-operation should be accorded in the compilation of the detailed statistics required for the purposes of the power survey and the rate investigation."

The conferences with the federal, state and municipal agencies were held during the week of April 16. The representatives of the public agencies in attendance at the conference were: Senator Homer T. Bone, E. F. Scattergood, J. D. Ross, Leland Olds, C. R. Reid, Llewellyn Evans, Carl Bock, Otto M. Rau, R. E. McDonnell, R. Husselman, Clayton W. Pike, Samuel H. Mildram and Louis Bartlett.

The conferences with the private electric light and power companies were held during the week of April 23. Representing the private companies were: Floyd L. Carlisle, P. B. Sawyer, Samuel Ferguson, Wendell L. Willkie, A. H. Markwart, Frank Comerford, Julius L. Hecht, N. E. Funk, William McClellan, William J. Hagenah, L. R. Nash, C. F. Hirschfeld, T. O. Kennedy, O. H. Funk, E. M. Gilbert, M. P. Leighton and Henry Flood.

Business is not perfect and never will be. It must march forward to meet and supply human needs and wants as they arise. Business becomes more complicated as our civilization becomes more complicated. A planned economy is undoubtedly necessary. In a sense it has always been a planned economy, but we need better plans, not more plans.

In the future there is going to be more government in business and more business in government, which will be beneficial to government as well as to business.

A. W. ROBERTSON,
Chairman of the Board,
Westinghouse Electric & Manufacturing Co.

Integrity is the basic quality of all enduring business, Mr. Robertson said, in a spirited defense of business honesty before the United States Chamber of Commerce, in Washington, this week.

E.H.F.A. to Provide Permanent Displays

Model electrical home to be built at Wilson dam. Permanent showrooms to be established at Chattanooga, Knoxville and Tupelo.

Permanent displays of electrical equipment will be set up by the Electric Home and Farm Authority at Chattanooga, Knoxville, Wilson Dam and Tupelo, Miss., David E. Lilienthal announced last week. All the displays will exhibit complete showings of equipment accepted by T.V.A. and E.H.F.A.

The display at Wilson dam will consist of a three-bedroom house, completely electrified. Air conditioning, range, refrigerator, dishwasher, water heater, laundry equipment and small kitchen appliances will appear in the showroom-home. E.H.F.A. demonstrators will be in attendance to illustrate the economies and benefits of the use of various appliances. Tourists may rest at an air-conditioned auditorium annex to the home, and witness moving picture demonstrations of electricity in home, factory and farm. Similar houses on a smaller scale will be installed indoors at several of the E.H.F.A. showrooms.

Meanwhile progress is reported on the construction of Norris and Wheeler dams. By June 1, both projects will be more than one-fourth completed, Chairman Arthur E. Morgan of T.V.A. announced last week.

Birmingham to Save $411,000 in New Street Light Contract

The city of Birmingham, Ala., this week signed a five-year contract with the Birmingham Electric Company for street lighting, cancelable by either party after three years. Present lighting facilities will be maintained at $41,000 less cost to the city annually. In addition the utility will erect 110 new light standards at an estimated cost of $18,000, of which the city will pay two-thirds.

NRA Warned Against Wage Rises

Durable Goods Committee report points to losses of heavy industries. J. S. Tritle, N.E.M.A. president, represents electrical industry in approving report. Price control discussed. Labor code authority representation scored.

The Durable Goods Industries Committee this week warned the National Recovery Administration against further wage increases or reduction in hours of labor. J. S. Tritle, president National Electrical Manufacturers Association, represented the electrical industry as a member of the committee. In a voluminous report, covering the committee's recommendations on 12 points for discussion suggested by Administrator General Hugh S. Johnson, the committee states that in its opinion "no attempt should be made to effect blanket increases in wages or reduction in code hours by executive approval." This group of industries "will suffer financial catastrophe and cease to be taxpayers and employers of labor," if present unprofitable operations are continued, the report states.

Other subjects covered included pricing methods and their effect under NRA, and code compliance as regards fair trade practices and labor relations. A recommendation that NRA take all labor disputes under its jurisdiction through code authorities was made in a discussion of the broad problem of labor relations under codes. The committee attacked the National Labor Board and the Wagner bill, and urged that "emphasis be placed on and encouragement be given to plans of plant employer-employee contact.

Unprofitable Operations. Durable goods industries as a whole have operated at a loss since 1932, the report points out, and continues: "The seriousness of these losses is accentuated by the fact that even under the most favorable circumstances the profit on the investment has not been large, because of the low rate of turnover. In 1929, one of our best years, the total sales reported were only 93 per cent of the total assets. It is evident from this that the durable goods industries turn over their capital less than once a year. The shrinkage of 28 per cent in total assets and 44.7 per cent in the surplus of the industries is mainly in cash, receivables and inventory; in other words, essential working capital. What remains is, for the most part, fixed assets such as land, buildings and equipment, already partly obsolete, which are largely non-liquid, are salable only at depreciated values, and simply represent an overhead expense.

"The committee believes that any further general increase in wages at this time would retard and not encourage recovery. For in the durable goods industries, where purchases can be postponed indefinitely, further increases in costs and resultant increased selling prices would tend to reduce the volume of sales and employment."

The report opposed the direct representation of labor and consumer interests on Code Authorities, stating that: "The entire recovery program contemplates the co-operation of industry under codes with the NRA. Real co-operation can only be secured when confidence has been established through understanding. Such machinery for handling disputes as the present National Labor Board or the proposed board of the pending Wagner labor disputes act encourages disputes and prevents the proper handling of employee and employer relationships. The first plank in the platform of satisfactory employee-employer relationship is a wage schedule which compensates the worker fairly and generously within the ability of the employer to pay. The second plank contemplates the establishment of safe and satisfactory working conditions. The third plank has to do with confidence as it is affected by factors other than Planks 1 and 2. Confidence building starts outside the gates and in the community."

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South African Research Revises Lightning Theory

New knowledge of the properties of lightning were brought out last week by Dr. B. F. J. Schonland of Cape Town University. Speaking before the American Meteorological Society in Washington, he reported the results of research in South Africa on the speed of lightning, its manner of building up voltages and the amount of these voltages. Dr. Schonland is director of research for the Institute of Electrical Engineers at Johannesburg. He worked on the tests with H. Collens of the Victoria Falls & Transvaal Power Company, as members of the lightning investigation committee. He is now in the United States to carry on investigations at the Department of Terrestrial Magnetism of the Carnegie Institution of Washington.

The lightning committee's findings show that the theory that the base of a cloud is positively charged is incorrect as promulgated several years ago by Prof. C. E. Simpson of London. The photographs of lightning flashes taken by the committee with a special revolving camera (ELECTRICAL WORLD, March 31, page 490), showed that the main flash of lightning traveled from ground to cloud over the exact path traversed immediately preceding by a "leader" flash from cloud to ground at a fraction of the main flash speed. Measurements by the committee indicated potentials of clouds in excess of 25,400 volts to the inch or more than 1,500,000,000 volts per mile. Generally the voltage is dissipated before it reaches such a potential, although he pointed out that thunderbolts have been estimated to reach 1,000,000,000 volts.

It was determined that these high potentials are built up by the splitting of drops of water in the cloud. Large drops from the positive top of the cloud fall by gravity to a lower level where small negative drops are discharged. The downward movement of these large droplets, Dr. Schonland stated, accounts for nine-tenths of the discharge within the cloud and the negative charge from the base of the cloud to earth accounts for the remaining one-tenth.

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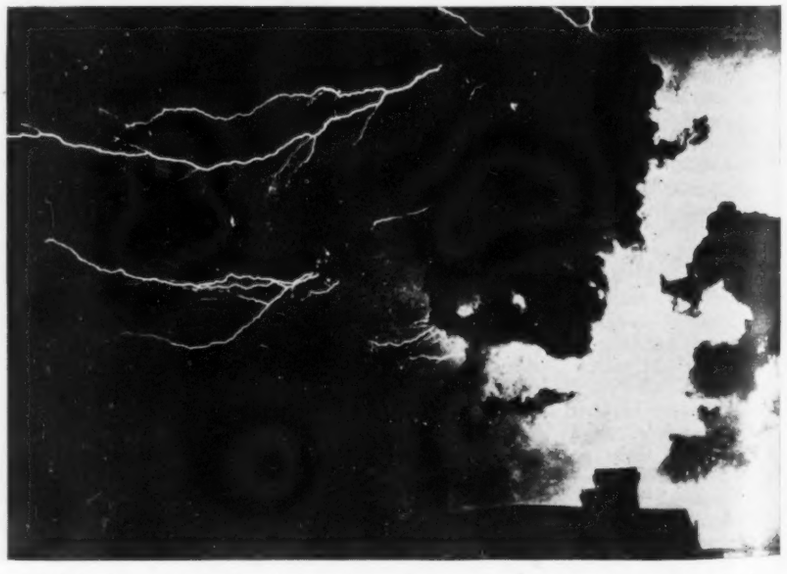
No Below-Cost Selling to T.V.A., N.E.M.A. Warns Manufacturers

Sales of electric appliances to Tennessee Valley Authority must not be made below cost, National Electrical Manufacturers Association warned its members this week. T.V.A., the association points out, is a government agency and compliance with basic code



Lightning over South Africa—from the camera studies of Dr. Schonland

conditions is mandatory in sales contracts involving federal expenditures. "No matter how attractive the volume involved, the association notice reads, nor how persuasive the T.V.A. officials may be for specially low prices on merchandise, sales must not be made below cost."

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Utility Contract Bill Killed; No Decision on Jersey Laws

After a stormy debate the New York State Assembly defeated the last of Governor Lehman's utility reform bills. This measure authorized the Public Service Commission to direct the public bidding of utility contracts in excess of $25,000, with the exception of maintenance contracts. All the other bills in the Governor's program have been passed and enacted into law.

The New Jersey Senate Judiciary Committee has reserved decision on six bills designed to afford greater state control over utility companies. The most important measure in the proposed legislation is the rate bill authorizing the commission to fix temporary rates pending ultimate determination by the commission through hearings. Another bill seeks to extend the power of the commission over transactions between holding companies and operating subsidiaries of a managerial and fiscal character. One of the bills is designed to vest in the commission supervision over the declarations of dividends.

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Truscon to Market Refrigerators

The Truscon Steel Company has entered the electric refrigerator field. Four models are included in the new line, ranging in size from four to 7½ cubic feet storage capacity. The refrigerators will be constructed at the Cleveland division of the company, and will be powered by Universal refrigerating units.

COMING MEETINGS

National Fire Protection Association—Atlantic City, N. J., May 14-18. A. R. Small, 109 Leonard St., New York.

American Institute of Electrical Engineers—Northeastern District meeting, Worcester, Mass., May 16-18. Summer convention, Hot Springs, Va., June 25-29. H. H. Henline, 33 W. 39th St., New York.

National Electrical Manufacturers Association—The Homestead, Hot Springs, Va., May 21-24. A. W. Berresford, 155 East 44th St., New York.

Edison Electric Institute—Atlantic City, N. J., June 4-7. B. F. Weadock, 429 Lexington Ave., New York.

Canadian Electrical Association—Annual convention, Seigniory Club, P.Q. (Lucerne-in-Quebec). June 13-15, B. C. Fairchild, 409 Power Building, Montreal, Que.

Public Utilities Advertising Association—Annual convention, New York City, June 17-20. Eric W. Swift, Commonwealth Edison Company, Chicago, Ill.

American Society of Mechanical Engineers—Semi-annual meeting, Denver, Col., June 25-28. Calvin W. Rice, 29 W. 39th St., New York.

Missouri Utilities Discuss Taxation

Municipal operation scored at annual meeting. 200 delegates hear plea for tax equalization, defence of rate structures.

Missouri municipal plant bills for average household service are 43 per cent higher than those of private utilities. Equalization of taxes so as to include municipal utilities should be undertaken at once. New Deal power projects should consider the investor's stake in the utilities.

These were the three major chords of discussion struck at the recently concluded annual convention of the Missouri Association of Public Utilities, held at Excelsior Springs, Mo. More than 200 Missourians came to be shown, remained to join in the spirited discussion of local and national utility problems and departed with a clearer picture of the educational and sales job immediately facing the industry.

Stricter cost accounting by municipal power plants was urged by O. F. Funk, controller of the Union Electric Light & Power Company. Citing the results of his comparative study of municipal and private rates, Mr. Funk stated:

"Even this, however, does not show the full cost of service. It does not reflect the fact that the citizens have had to invest their money in municipal plants and receive no interest on it. Giving effect to this additional cost, and giving due credit to municipal plants for free street lighting services and such profits as may accrue to the municipality, it is found that the full cost of municipal service is 85 per cent higher than company service."

Joseph F. Porter, president of Kansas City Power & Light Company, urged a continuation of the campaign for tax equalization between municipal and privately owned utilities, and described the campaign waged by utilities of Kansas City in a state-wide effort to force municipal plants to pay the same state sales tax as that levied on private utilities.

Fred Karr, president of the St. Joseph Gas Company, was re-elected president of the association at the meeting. Other new officers are: First vice-president, C. E. Michel, Union Electric Light & Power Company, St. Louis, Mo,; second vice-president, C. F. Farley, Kansas City Power & Light Company, Kansas City, Mo.; third vice-president, D. W. Snyder, Jr., Missouri Power & Light Company, Kansas City, Mo.; treasurer, Hermann Spoehrer, Union Electric Light & Power Company, St. Louis, Mo.; secretary, N. R. Beagle, Missouri Power & Light Company, Jefferson City, Mo.; assistant secretary, Jesse Blythe, Jefferson City, Mo.

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To Divide Motor Group?

Broadened activities of the motor and generating section of the National Electrical Manufacturers Association have resulted in proposals that the section be divided into four main groups. The breakdown will probably be—fractional horsepower, integral horsepower, low voltage or special generator and large apparatus.

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Lamp Prices Cut 58% in 12 Years

Net prices of incandescent lamps have been reduced 58 per cent since 1921. In a statement accompanying current dividend checks the General Electric Company points out that the 1933 average lamp price is lower than it was in 1930, 1931 or 1932, despite increased manufacturing costs and shorter working hours.

——THIS WEEK IN WASHINGTON

Contracting code meets objections . . Propose restrictions of mail hand-delivery . . Another power probe? . . Mark time on Johnson bill.

Renewed objection to the electrical contracting code has been filed with the National Recovery Administration by the Machinery and Allied Products Institute. It is contended that electrical installation, maintenance and service in manufacturing plants should be done by the particular industry for its own account and not under the terms of the electrical contracting code.

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An effort is being made to break up the alleged practice of many private corporations, firms and individuals of delivering large number of letters by messenger and thereby avoiding the payment of postage. The post office and post roads committee of the House of Representatives has recommended the passage of legislation which will make it necessary for the sender to pay postage on letters delivered by messenger when more than five letters are delivered in this manner. This change in the law is said to be necessary to protect the government's revenue, and to stop a practice which is in effect violating the government's monopoly in the transportation and delivery of mail.

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A means of reducing the cost of producing and distributing electricity is the avowed purpose of a resolution introduced by Senator Ernest W. Gibson of Vermont. The resolution proposes that a select committee of the Senate be appointed "to make a study of the methods of production and distribution of electricity and confer with and advise the President concerning plans for the adoption of some method of production and distribution that will insure low cost to the consumers." The resolution has been referred to the committee on interstate commerce.

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No date has been set, at the time of this writing, for the consideration of the bill involving the jurisdiction of district courts in the handling of utilities cases. Consideration of this legislation has had to await the handling of the stock exchange regulation bill and other measures.

PAUL WOOTON,
Washington Correspondent.

Electric Heating Engages Ceramists

Joint Asheville convention of electrochemists and ceramists appoints committee to study electric firing of porcelain and refractories. Resistor alloy developed.

A new movement is under way to develop more widespread use of electric heat in the ceramic industry. A committee to study American practices and requirements, in the light of the success in Europe with electric firing of porcelain and refractories, was appointed last week at the joint convention of the Electrochemical Society and the American Ceramic Society in Asheville. Perry Helser, vice-president of General Ceramics Company, will head the group, which will comprise R. E. Gould, A. V. Blaininger, and Professors C. G. Fink and A. E. Greves-Walker, with S. T. Henry of Spruce Pine, N. C., acting as executive secretary.

The committee is negotiating with the Tennessee Valley Authority for aid in conducting research in this field. Judging from the vigorous comments by Ross Purdy (secretary of the Ceramic society) on the ineffective "toasters" which the electrical industry has offered the ceramic industry, the committee faces the task of satisfying that industry that electric heat does afford means of meeting its high temperature and difficult heat-penetration problems.

New resistor alloy—Professor C. G. Fink of Columbia University announced that he had, in the laboratory, a new alloy for resistors which not only promises to give satisfactory life at 1,600 deg. C. but also to lend itself to ceramic furnace application, in which the atmospheres and heat conductivities are radically different from the metal melting and heat treating to which electric heat has been so extensively applied. Another paper on the electrochemical part of the program announced the development of a synthetic rubber which acts physically like bonafide rubber and when made into 60 per cent "rubber" insulation has about the same strength as true rubber compound. But it has one striking difference in that it possesses only about one per cent of the specific insulation resistance while having several times the specific inductive capacity of rubber, the latter a matter of high dielectric strength. This was couched in a paper by H. Eugene Mason of Ridgewood, N. J., which recorded progress in setting up an accelerated life test for rubber on the basis of the exponential relation of voltage and times to breakdown.

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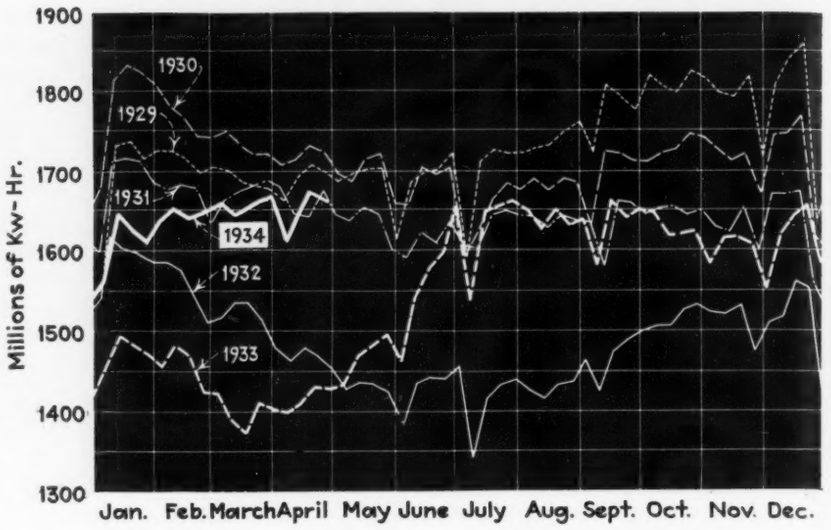
British Plants Modernized

The city of Sheffield, England, will undertake the extension of its two power stations. An expenditure of £770,000 will be made to provide for installation of a 30,000-kw. turbo-alternator to replace the existing plant at the Neepsend station. An identical unit will also be added at Blackburn Meadows station.

Creeping Up on 1930



Central-station energy output during the week ended April 28 greatly surpassed that of the corresponding week last year. The high rate of gain over 1933 shown in the past few months continues. It was 16.8 per cent, according to the Edison Electric Institute. The amount, 1,668,564,000 kw.-hr., fell only slightly short of the 1934 record set by the preceding week. With that exception it was ahead of any other in 1934 and far ahead of production at any time throughout 1932 and 1933.

Most striking feature of all, production has now approached within 3.3 per cent of what it was at the same period of 1930, the year of greatest springtime operations. Meanwhile the upward trend, unprecedented for the early months of any year, is being maintained. In the central industrial area the recent unusual excess over 1933 is again in evidence, with high rates also in other sections.

Weekly Output, Millions of Kw.-Hr.

1934		1933		1932	
Apr. 28..	1,669	Apr. 29..	1,428	Apr. 30...	1,455
Apr. 21..	1,673	Apr. 22..	1,431	Apr. 23...	1,470
Apr. 14..	1,642	Apr. 15..	1,410	Apr. 16...	1,481
Apr. 7..	1,617	Apr. 8..	1,399	Apr. 9...	1,465
Mar. 31..	1,666	Apr. 1..	1,402	Apr. 2...	1,480

Per Cent Change from Previous Year

Region	Week ended Apr. 28	Apr. 21	Apr. 14
New England.....	+16.7	+15.7	+16.5
Middle Atlantic....	+12.3	+13.3	+12.5
Central Industrial..	+22.6	+22.4	+22.4
West Central.....	+10.6	+11.2	+10.2
Southern States....	+17.2	+16.5	+15.5
Rocky Mountain...	+25.2	+20.4	+16.8
Pacific Coast.....	+12.5	+13.3	+14.3
United States....	+16.8	+16.9	+16.5

Welding Society Committees Report on Today's Research

Current welding research on seat angles for beams and a proposal for a study of ductility of weld metals were the chief topics of discussion at the afternoon session of the fifteenth annual meeting of the American Welding Society in New York April 26. C. A. Adams, director of the American Bureau of Welding, presided, while the report of committees for the year were read. A proposal of Prof. Albert Sauveur of Union College was read and discussed which called for an investigation of the ductility of weld metals in relation to other properties and required safety of the welded product.

The plan would require the employment of two investigators and a typist for first making an investigation and co-ordination of all published material and individual manufacturers' research, from which it can be determined what research would be necessary for an exhaustive and comprehensive analysis of the picture. The second part would be the actual experimental research leading to a complete published analysis of ductility. Representatives of several interested companies were personally in favor of at least the first part, and it was finally decided that Mr. Adams should endeavor to make a plan by which the President's Advisory Science Board and industry firms might agree to finance the project.

L. S. Moisseiff, chairman of the structural steel welding committee, presided, while Prof. Inge Lyse of Lehigh University outlined the proposed program of seat angle tests now being conducted at the university by assistants with the financial aid of the welding society. Norman J. Schreiner, research fellow, reported the method and results of pilot tests already conducted by him on angles of different dimensions, points of load application and electrodes. All tests are being made with plain wire electrodes, with the exception of one or two cases where covered electrodes were used for comparison. After these tests are completed actual beams mounted on seat angles will be tested.

Considerable discussion was devoted to methods of designing and welding seat angles other than those laid down for the test. Financial assistance for the second year of the project was voted.

As to Rates—

• Western United Gas & Electric Company began defense of its northern division's electric rate structure at a hearing held last week before the Illinois Commerce Commission. George Vasselago, engineering expert for the company, testified to a present-day valuation of the properties of $10,795,900, reproduction cost new, excluding discount and financing expense. At a previous hearing commission counsel maintained that the company's first exhibit, constituting an appraisal of its properties, clearly indicated that the company had earned substantially more than a 6 per cent fair rate of return last year.

• Pennsylvania Public Service Commission has overruled City Controller S. Davis Wilson's objections to the conduct of the Philadelphia Electric Company's rate hearing (ELECTRICAL WORLD, April 28, page 634). Mr. Wilson had objected to the actions of Commissioner Frederick P. Gruenberg in allowing the company to enter exhibits showing electric bill reductions to consumers, on the ground that the company was required only to justify the cases where increases resulted from its new rates. "If the commission as a whole were to pass upon every offer of evidence on which objection is made," the commission stated, "no major case before the commission could be completed short of a period of many years." The commission also refused Mr. Wilson's demand that it prescribe the manner in which the company may present its case.

• Tennessee Railroad and Public Utilities Commission has ordered an electrical rate reduction averaging 25 per cent for domestic consumers in 31 west Tennessee and middle Tennessee cities. The cut became effective May 1. The towns involved are served by the Kentucky-Tennessee Light & Power Company, the Dover Power Company and the Southern Utilities Company. The slash ordered on all types of service averages 15 per cent.

• Northern States Power Company and its subsidiary, Minneapolis General Electric Company, are accused of charging unreasonable residential rates in a suit filed by John G. Priebe, Minneapolis attorney, in Hennepin County District Court. The suit charges that the electric company is doing business without a franchise or contract and has set arbitrary rates which are unreasonable. Petition asserts that too great a preference is being shown industrial and commercial users.

• Nebraska State Railway Commission has overruled the objections of the Southern Nebraska Power Company. It has entered an order holding its jurisdiction to regulate and fix reasonable rates for electric service upon the application of the consumer whenever and wherever electric energy is delivered for consumption outside of the limits of a municipal corporation. The case was brought before the commission on the complaint of patrons. It was claimed that by a trick the company was attempting to nullify the act of the Legislature forbidding any service charge. Before that law became effective, the farmers paid a $3 monthly service charge and a 7 cent rate per kilowatthour for the first fifty and 4 cents thereafter. The rates complained of were the fixing of minimum charges of $3.84 per month for the first 12 kw.-hr., 7 cents for the next 38 and 4 cents thereafter. The majority opinion of the commission sustains the charge that the law is contravened by the new charges.

• North Dakota Railroad Commission has ordered 25 per cent of the revenue of the Northern States Power Company at Minot impounded pending an investigation and establishment of new rates. This action has been taken following the passage of a law by the last Legislature requiring the board to impound 25 per cent of the revenues when requested to do so by a petition signed by a certain number of the consumers.

• Indiana Public Service Commission has been temporarily restrained by Judge Thomas W. Slick of the Northern Indiana Federal District Court from enforcing its electric rate reduction order against the Public Service Company of Indiana (ELECTRICAL WORLD, April 28, page 634). The order reduced the company's revenues approximately $1,000,000 a year and affected 270 cities and towns in central and southern Indiana. Four points on which the company sought the injunction were: That the commission did not have legal evidence to justify a rate reduction; that the proposed rate is confiscatory; that the order is void because the commission did not make a finding of facts, and that the evidence before the commission did not set out facts necessary for issuing an order.

• Northern Indiana Public Service Company's new rate schedules for electric service in nineteen towns have been approved by the state Public Service Commission. The rate offers a reduction of about 10 per cent, but provides for a higher monthly minimum charge.

• Indiana Public Service Commission has passed a blanket order requiring all utilities to submit monthly reports. Forms have been sent out by the accounting department which provide for detailed information regarding earnings, expenditures, property improvements, dealings with affiliated companies and other pertinent information. Up to the present time companies have been required to report only once each year.

• Tennessee Public Service Company, Knoxville, has been ordered by the state public utility commission to reduce its electric rates 16 per cent. The saving to consumers is estimated at $230,000 annually. This reduction, contemplated for some time, has been held in abeyance pending the outcome of negotiations between the utility and the city of Knoxville on the purchase of the company's property. Believing such a development now hopeless, the commission ordered the reduction so that consumers would not have to wait until the municipal plant is constructed for lower rates.

Hydro Engineers Tackle Economies

Weather forecasting, storage efficiency, generation improvements, load allocation, receive attention at Washington meeting of Pennsylvania hydraulic group.

Greater energy output and better economy from present hydro plants was the theme of the meeting of the hydraulic power committee of the Pennsylvania Electric Association held in Washington, D. C., last week. Advance flow forecasting, better use of storage, increased generating efficiency and better utilization of energy on the system load comprised the chief topics.

Three papers dealing with weather forecasting were presented at the meeting. C. F. Merriam of the Pennsylvania Water & Power Company presented the paper "Long Range Forecasting"; Dr. C. G. Abbot of Smithsonian Institution repeated the paper "Studies of Weather Periodicities," which he had presented before the Academy of Sciences, and G. E. Dunn of the United States Weather Bureau interpreted "The Weather Map and Forecasts."

On the subject of hydrology five papers were presented. F. W. Lohman, of the United States Geological Survey, summarized "Ground Water Studies in Pennsylvania"; J. W. Mangan, district engineer of the United States Geological Survey at Harrisburg, Pa., described "Co-operative Hydrographic Work in Pennsylvania"; H. W. Lowy of the Pennsylvania Water & Power Company, Holtwood, Pa., gave a discussion of "The Known Errors in the Computation of River Flow at Holtwood," amplifying a previously printed paper describing this computation; R. A. Lane of the Susquehanna Electric Company, Conowingo, Md., described "Computation of River Flow and Storage at Conowingo"; E. S. Loane of the Pennsylvania Water & Power Company, Baltimore, Md., followed with a very interesting paper on "The Comparison of Flow Measurements at Conowingo, Holtwood, Safe Harbor and Chickies Creek."

Two excellent papers were presented on efficient generation and utilization of hydro-electric power; first, "Control of Operating Economy in Hydro-Electric Plants," by H. A. Von Eiff and C. W. Watchorn of the Pennsylvania Water & Power Company, Baltimore, Md. (ELECTRICAL WORLD, this issue, page 660), and "The Allocation of Loads to Conowingo Hydro Station," by H. Estrada and J. Finlaw of the Philadelphia Electric Company, Philadelphia, Pa.

Rapid City Votes Down Plant

By an overwhelming vote a proposal to establish a hydro-electric municipal light and power plant at Rapid City, S. D., was defeated at an election held April 17.

Citizens of Marion, Ind., will ballot June 5 on the proposition of operating a municipal light and power plant.

FINANCIAL · · · BUSINESS

Consolidated Gas Cuts Dividend

Third reduction in year. $2 basis results from increased taxes, lower rates, NRA operation, Cortelyou says. Quarter's earnings $1.10 on common stock.

The third dividend reduction within a year was announced last week by Consolidated Gas Company, New York. The new rate on common stock will be 50 cents quarterly, against 75 cents. In April, 1933, the company reduced its common dividend from $4 to $3.40 on an annual basis. Six months later the rate was reduced to $3.

George B. Cortelyou, Consolidated president, announced that reduced rates, increased taxes and additional operating costs encountered under NRA operation brought about the decision to reduce the rate. It was intimated that further income cuts are probable, as a result of the recent Lehman utility program.

Earnings are $1.10—A statement issued by the company last week shows that earnings in the quarter ended March 31 were equal to $1.10 a share on the common stock. Operating revenues for the first quarter were $62,983,646, compared with $62,662,235 in the same 1933 period, an increase of $321,411. Net income, however, declined $3,723,536, standing for the quarter at $15,424,171, compared with $19,147,707 in 1933.

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Niagara Hudson Income Shows First Quarter Gain

An increase in consolidated net income for the first 1934 quarter was reported this week by Niagara Hudson Power Corporation and subsidiaries. Net income for the quarter was $2,211,961, equal to 25 cents a share on 8,738,135 common shares. In the same 1933 period their net income was $1,603,306, or 18 cents a share. Net income for the twelve months ended March 31, however, showed a decline from the previous year's period. At the end of March consolidated net income for the year stood at $6,386,357, or 73 cents a share, comparing with $7,436,328, or 85 cents a share, in the preceding twelve months.

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G.E. and Westinghouse Cut R.C.A. Holdings to 7½%

Only 7½ per cent of the outstanding common stock of the Radio Corporation of America is now held by the General Electric Company and the Westinghouse Electric & Manufacturing Company. This compares with 61 per cent owned when the consent decree that dissolved the relationship between the electrical manufacturers and R.C.A. was entered on November 21, 1932.

General Electric Company in 1933 distributed 4,807,321 of its 5,188,755 common shares in R.C.A. to its stockholders, while Westinghouse disposed of 1,334,000 of its 2,842,950 shares in like manner. General Electric now holds only 134,516 common shares of Radio, while Westinghouse has sold more than one-third of the shares held following the stock dividend. They have nineteen months in which to dispose of the remainder of their holdings.

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Gary Utility to Extend Bonds

Gary Electric & Gas Company, Hammond, Ind., will ask holders of its $8,000,000 issue of first lien collateral 5 per cent bonds due July 1 to accept an extension of the maturity date. The Gary utility is controlled by the Midland Utilities Company.

Ferguson Points Path to Expansion

Urges promotion of home load to balance with industrial in plain talk to U. S. Chamber of Commerce. Muir says "capital goods industry faces vast opportunity now waiting for aggressive selling."

Development of domestic energy usage is the key to expanding the power market and application of this principle will lead to lower industrial rates in due course. Samuel Ferguson, Hartford Electric Light Company's president, said this to the United States Chamber of Commerce at its annual meeting in Washington this week.

A better balance between usages and more economic employment of utility investment will result from this policy, Mr. Ferguson believes. "It is absurd to ask householders to electrify their homes," he said, "at prices perfectly justified by the smallness of the earnings derived from present limited usage. Domestic prices must be fixed which will attract and develop a business which is today non-existent, or nearly so, such as cooking, water heating, air conditioning, etc. This means the use of so-called promotional rate schedules which hold present revenues for present usage, but which offer really low prices for the additional potential usage. In making the necessary rate adjustment, of necessity a certain amount of present revenue must be sacrificed.

"Instead of directly and immediately applying the savings which will result from economies to industrial power prices, treat these savings as seed corn too precious for consumption. Plant the seed corn first in the domestic field, and when the fields bring forth, some sixty-fold and an hundredfold, then apply the harvest to making a real improvement in industrial prices. This, in turn, will produce another harvest, which can then be distributed over all branches of business and serve to promote the well-being of our nation."

Muir speaks for capital goods—The capital goods industry must perform the spring cleaning for the consumer goods manufacturers, if the latter is to begin capital investment, Malcolm Muir, president of McGraw-Hill Publishing Company, Inc., and former NRA divisional administrator, told the chamber.

"The capital goods industry is faced today with one of the greatest selling opportunities in its history," he said. "The dissemination of adequate information, peculiar to every industry, can aid in the release of capital investment now lying dormant for lack of an aggressive selling campaign. This information should show how costs may be cut, and how the special problems of each plant may be solved through the installation of low-cost equipment. This can often be done by the simple expedient of showing the conditions under which capital goods replacements become economically sound.

"I am convinced," Mr. Muir said, "that beyond industry's own ability to finance its capital requirements, the government itself must step in, as it plans to do. It must supply a credit primer in the form of direct loans to the small units of industry which in the past have secured their money from local banks or capitalists, and not through the issuance of securities."

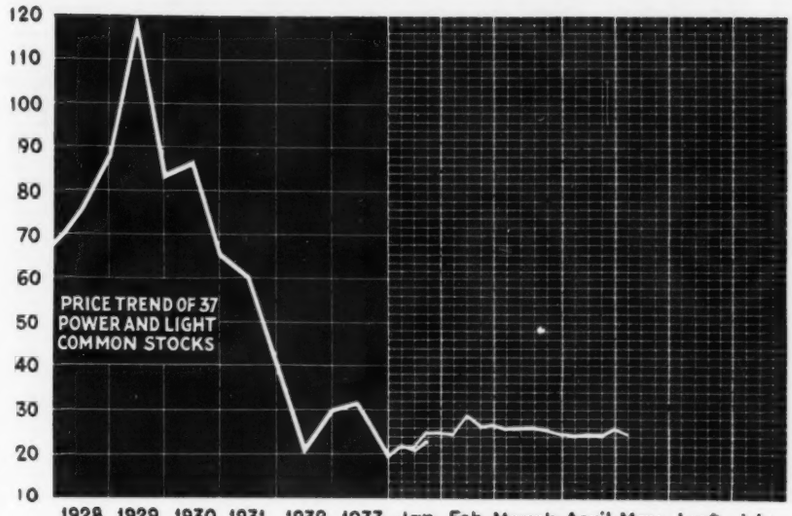
WHAT NEXT?

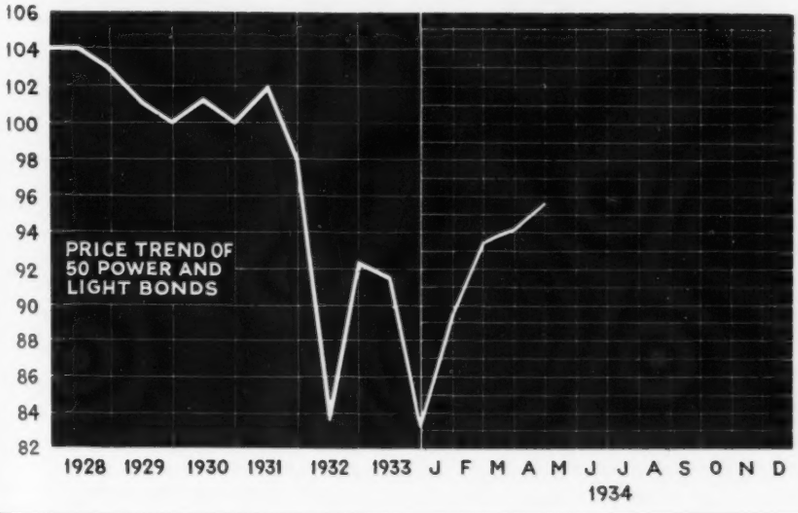
Suffering with a moderately bad case of the jitters, financial and commodity markets this week made a showing that revived some business doubts. Reasons for this pessimistic state of the speculative mind may be: Sustained doubts as to the declines which may follow the passing of the spring peak of business, perceptible current falling off in consumer goods sales, suppression of inflationary forces—notably the silver bloc—and the likelihood of an early test of commodity and product price levels.

Doubt as to just what to expect next in the business barometers may unsettle the optimism of those who look ahead, but should not disturb the optimism of those who look far enough ahead. The New Dealers mean to win, and election day is not too far off to make sustained business activity a necessity.

Figures of the week are encouraging. Energy production, virtually at last week's level, remains 17 per cent above last year. Carloadings 1.8 per cent over previous report and 18.7 per cent over a year ago. Automobile output contra-seasonally exceeds the week previous. Steel mill activity at year's peak and highest point since August, 1933.

Bonds Up; Stocks Recede





Strong demand for high-grade bonds has resulted in a further rise in prices. Stocks, in a reactionary market, lost some ground during the week. *Electrical World* averages: Bonds, 95.9 April, 94.3 March; stocks, 24.8 this week, 26.1 last week.

Missouri Court Upholds Laclede Stock Acquisition

The Missouri Supreme Court *en banc* in a recent decision authorized the Utilities Power & Light Corporation of Chicago to take direct stock control of the Laclede Gas Light Company and the Laclede Power & Light Company. This reverses a prior ruling that the public benefit must be shown before the state Public Service Commission may authorize a foreign holding company to acquire and hold more than 10 per cent of the capital stock of a public utility. The ruling also reversed Division No. 2 of the Supreme Court in the same case, which held that the proposed acquisition of the stock in the Laclede companies by the Utilities Power & Light Corporation from an intermediate holding company which it also controlled was "contrary to public policy and unlawful in the circumstances" (ELECTRICAL WORLD, April 29, page 533).

Stock control of the Laclede Gas Light Company and the Laclede Power & Light Company is now held by the Laclede Gas & Electric Company, which is controlled by the Utilities Power & Light Corporation. Four years ago the commission issued an order permitting Utilities Power & Light to take over the stock in the subsidiaries and to dissolve the Laclede Gas & Electric Company. The city of St. Louis appealed from the commission's order.

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Sangamo Increases Wages

Sangamo Electric Company, Springfield, Ill., has announced a ten per cent increase in wages effective May 1. Approximately 700 employees will be affected.

Insull Receivership Sustained by Court

No fraud or collusion found in Middle West Utilities receivership proceedings. Reorganization plans announced for subsidiaries. To include bond exchange.

Validity of the equity receivership of the Middle West Utilities Company has been upheld by Federal Judge Walter C. Lindley. Neither fraud nor collusion was attempted or practiced in the meetings and court action leading to the placing of the company in receivership, according to the ruling of Judge Lindley. In concluding the fifty-one-page decision, he said: "It seems to me that the accomplishments to date have been promotive of the best interests of the estate and the beneficiaries."

The effect of the decision is to continue Charles A. McCulloch as equity receiver. The ruling was the result of an open hearing of almost two months, during which Samuel A. Ettelson, former Corporation Counsel of Chicago, attempted to prove that the equity action was the result of collusion between Chicago and New York banks and the Insull companies to defraud stockholders and creditors (ELECTRICAL WORLD, January 20, page 129, and February 10, page 234.)

Units to be reorganized.—Reorganization plans have just been announced for the United Public Utilities Company and the United Public Service Company, Middle West subsidiaries, which went into receivership in April, 1932. The plan worked out by the protective committees and now being sponsored by a re-organization committee has received approval of the federal district court in tentative form and has been agreed to by the various protective committees involved. All that remains before the plan can be declared operative and lift the receiverships is formal approval of the final legal draft of the plan by the court and acceptance by a sufficient number of the various classes of security holders.

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G.E. Gets Large Furnace Order

General Electric Company has received the largest order ever placed for a single oil furnace installation, the company reports. The sale consists of 150 oil furnaces to be used for the complete heating of Mt. Holyoke College at South Hadley, Mass.

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Yale & Towne Reports Profit

Net profit of the Yale & Towne Manufacturing Company for the quarter ended March 31 after taxes, depreciation and other charges amounted to $21,254. This is equal to 4 cents a share on 473,556 capital shares of $25 par value, excluding 13,100 shares bought by the company for resale to employees. The profit reported contrasts with a net loss of $107,093 in the first quarter of 1933.

Refrigerator Makers Report Unprecedented Sales Volumes

Electric refrigeration is having a record-breaking season. The refrigeration bureau of Edison Electric Institute reports March sales totaled 151,668 units, nearly three times the volume of the same 1933 month. Sales for the first quarter of 1934 set a new all-time record with 269,319 units sold, against 112,643 units in the first quarter of 1933, and the previous record of 170,793 sold in the first quarter of 1931.

Westinghouse Electric & Manufacturing Company echoes the institute's glad tidings. March sales of Westinghouse refrigerators were 97 per cent above the same 1933 month. According to R. C. Cosgrove, Westinghouse manager of that department, first quarter totals are more than 30 per cent higher than for the first quarter in 1933. More orders were received during the first seven days of April than during the entire month last year.

Norge Corporation points to its record for the first 100 days of 1934. Total orders to April 15 were nearly four times those of the same 1933 period and represented 78.6 per cent of total shipments for the entire year of 1933. Four six-hour shifts daily are now working at the corporation's Muskegon plants, President Howard E. Blood announced. Capacity operation is expected for some time, since unfilled orders stand at 1,400 per cent of those a year ago.

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Chase Brass & Copper Enters Lighting Fixture Field

Chase Brass & Copper Company, Waterbury, Conn., has entered the electric lighting fixture field. Employing a franchise plan of dealer distribution, the company will display a complete line of residential fixtures of all types and periods.

Distribution has been under way for two weeks, and a national advertising campaign, utilizing home magazines, will begin June 20. A permanent exhibition has been set up in New York City and will be opened on May 15. Earl F. Copp is general manager of the lighting fixtures division, and Clement E. Horton is in charge of sales.

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International Lamp Reorganized

International Incandescent Lamp Company, Hoboken, N. J., has been reorganized as the Northern Incandescent Lamp Company. Lamps under the brand name of "Northern Lights" will be manufactured under the engineering supervision of Max Moeller. Officers of the new company, which has purchased the assets, including plant and fixtures of the International Company, are A. M. Johanson, president; A. Irving Boyer, Jr., vice-president; Louis M. Rosenthal, vice-president; Robert G. Werner, secretary-treasurer.

New York Metal Prices

	Apr. 24, 1934 Cents per Pound	May 1, 1934 Cents per Pound
Copper, electrolytic	8.50	8.50*
Lead, Am. S. & R. price	4.25	4.25
Antimony	7.95	7.95
Nickel ingot	35.00	35.00
Zinc, spot	4.75	4.75
Tin Straits	55.875	55.25
Aluminum, 99 per cent	23.30	23.30

*Blue Eagle

SALES OPPORTUNITIES IN NEW CONSTRUCTION

Spot coverage of the week. Projects approved and proposed, bids requested, equipment wanted, funds available. Prospects for the electrical manufacturer.

Generators and accessories, boilers, pumps and auxiliary equipment will be installed in new power plant at factory of Dayton Rubber Manufacturing Company, Dayton, Ohio. Cost about $70,000.

Guttenberg, Iowa, asks bids until May 21 for equipment for city-owned electric light and power plant, including two Diesel engines direct-connected to two 200-kw. generators, exciters, fuel unloading and storage system, pumping equipment, switchboard and instruments, meters and miscellaneous equipment. Fund of $70,000 available.

Motors and controls, air compressors, pumping machinery and other equipment will be installed in new gasoline refining plant in Naval Reserve District, Osage County, Okla., of Phillips Petroleum Company, Bartlesville, Okla.

Fund of $125,000 is being arranged by Essex County Board of Freeholders, Newark, N. J., for extensions and improvements in power plant at county hospital, Overbrook, Verona, N. J.

Motors and controls, regulators, power substation equipment, electric hoists, conveyors and other equipment will be installed in new mill and at gold-mining properties of Phoenix Gold Mining Corporation, Reno, Nev., care of Rodney M. Davis, 1124 North 76th Street, Seattle, Wash., president. Fund of $200,000 is being arranged.

Big Horn-Black Hills Power Association, Spearfish, S. D., D. W. George, secretary, soon begins initial surveys under federal direction for proposed hydro-electric generating plant on Platte River, near Casper, Wyo., including power substations, switching stations, transmission lines and distributing systems for service in Big Horn and Black Hill mountain districts. Estimated cost $8,217,000 and fund in that amount is being arranged through federal aid.

University of Mississippi, Oxford, Miss., plans extensions and improvements in power plant at institution, including installation of new equipment, to cost $65,000; similar program will be carried out in power plant at State Teachers' College, Hattiesburg, Miss., to cost $60,000.

Stoughton, Wis., plans installation of new standby electric generating unit at city-owned electric light and power plant. Financing for $125,000 is being arranged.

Fort Pitt Brewing Company, Sharpsburg, Pa., plans extensions and improvements to double present capacity. Cost about $200,000.

Heavy-duty motors and controls, unloading and conveying equipment, electric hoists, etc., will be installed in new refuse incinerator plants to be constructed by Columbus, Ohio. Bids will be asked in June. Cost about $200,000.

Until May 21, Valley City, N. D., asks bids for equipment for city-owned power station, including 600-hp. boiler, stokers, superheater, air preheater, forced and induced draft fans, automatic combustion control equipment, meters, instruments, etc.

Bids will be received by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 11 for quantity of insulated electric cable for Eastern and Western navy yards (Schedule 2298).

Transformers and accessories, heavy-duty motors and controls, electric hoists, conveyors and other equipment will be purchased for new mill at Lincolnton, N. C., of American Consolidated Tin Mines Corporation, New York, for which bids will soon be asked. Initial unit will have ore-handling capacity of about 500 tons daily. Cost about $250,000.

Grand Rapids, Mich., plans purchase of new equipment for city-owned power plant, including boiler unit and accessories. Cost about $40,000.

East Side Winery, Lodi, Calif., plans new multi-unit plant. Cost over $100,000, with equipment.

Chandler, Okla., has secured federal loan and grant for $142,000 for new city-owned electric light and power plant and plans early construction.

Heavy-duty motors and controls, conveyors, electric hoists, etc., will be installed at new coal tipple at Puritan, Colo., of National Fuel Company, Denver, Colo. Cost about $100,000.

Fleischmann Malting Company, Minneapolis, Minn., plans addition to plant at Red Wing, Minn. Cost about $40,000, with equipment.

Virgin Islands Company, St. Thomas, Virgin Islands, West Indies, plans extensions and improvements in group of sugar mills and refineries, and liquor distilleries, including installation of new equipment. Fund of $1,000,000 has been allotted by Public Works Administration, Washington, D. C., for entire project.

Lamoni, Iowa, has authorized new city-owned electric light and power plant at special election and fund of $97,000 will soon be arranged. Diesel engine-generator units will be installed.

Rainier Brewing Company, Seattle, Wash., plans extensions and improvements, with installation of new equipment for increased capacity. Cost over $350,000.

MEN OF THE INDUSTRY

Mildon New Vice-President of Westinghouse Electric

R. B. Mildon has been elected vice-president of the Westinghouse Electric & Manufacturing Company. He will be in charge of the operations of marketing, engineering, manufacturing and servicing of the products of the South Philadelphia works. A graduate of

Cornell University, Mr. Mildon at first was employed by the Union Pacific Railroad and the Colorado Fuel & Iron Company in an engineering capacity. Following a term as chief engineer with the Duquesne Mining Company he became associated with the Westinghouse company in charge of the gas producer department of the machine works at East Pittsburgh. Three years later he was transferred to the Westinghouse Air Spring Company and re-entered the employ of the Westinghouse Electric & Manufacturing Company in 1916 as assistant to vice-president. Recently he has been in charge of the stoker department.

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F. W. Patterson of the General Electric Company was elected president of the Electrical Club of Montreal.

Arthur Meighen has resigned as a member of the Ontario Hydro-Electric Power Commission.

H. B. Allen has been appointed general manager of the New Jersey Power & Light Company, Dover, N. J. Mr. Allen was formerly manager of the Metropolitan Edison Company at Lebanon, Pa.

Earl Jarvis, of the Jarvis Electric & Refrigeration Company, Vancouver, B. C., has joined Marshall-Wells B. C., Ltd., western Canada distributor for Kelvinator. He will be in charge of commercial refrigeration sales. Mr. Jarvis has been active in trade association work and a charter member of every electrical association that has ever been organized in Vancouver. He is also a member of the Illuminating Engineering Society. His son and partner, C. B. Jarvis, continues as active manager of Jarvis Electric.

E. H. Ott has been appointed commercial manager of the New Jersey Power & Light Company.

Maxfield Pease has been appointed exclusive sales representative for the entire Northern Ohio territory for H. O. Swoboda, Inc., of Pittsburgh, Pa.

Roger S. Ruffin, easement agent for the San Diego Consolidated Gas & Electric Company, was elected president of the Electric Club of San Diego at its recent annual meeting.

Harry W. Hough has been elected vice-president and general manager of the Cleveland Electric Illuminating Company. Mr. Hough has been associated with the Cleveland utility for twenty-four years.

James Land is now with the Drendell-Trumbull Electrical Manufacturing Company in its San Francisco headquarters. He was formerly with the Frank Adams Electric Company in San Francisco.

H. G. D. Nutting has left the Detroit Edison Company to organize and become president of the Efficient Devices Company. This company will manufacture electric water heaters and other domestic electrical appliances. Mr. Nutting has had a long and varied career in the public utility business, having held executive positions with utilities in Wisconsin and Illinois and with municipalities. He was an engineer for the Wisconsin Railroad Commission in the early days of that regulatory body and has appeared as an expert on rates and valuations in many rate cases since that time. He has been in the power sales division of Detroit Edison for the past nine years. Besides his manufacturing connections he will also carry on a consulting engineering practice.

C. E. Dove has been appointed manager of the Dubuque, Iowa, division of the Interstate Power Company. He succeeds R. H. Garrison, who has been appointed manager of the company's northern division at Albert Lea, Minn. Mr. Dove has been identified with the Utilities Power & Light Corporation, which controls Interstate Power, for a number of years. He is well-known in Dubuque, having held several managerial positions with the local utilities.

J. L. Taylor has entered the sales department of the Cleveland Electric Illuminating Company. For several years he was sales manager and buyer of the electrical department at William Taylor Sons & Company, and a member of the sales promotion department of the Westinghouse Electric & Manufacturing Company. Mr. Taylor will assist appliance dealers throughout the city with merchandising problems.

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D. S. Jacobus Heads American Welding Society

Dr. David S. Jacobus, one of the foremost American mechanical engineers, has been elected president of the American Welding Society. Since 1906 Dr. Jacobus has been actively associated with the Babcock & Wilcox Company

at the head of its engineering department in the position of advisory engineer. Following graduation from the Stevens Institute of Technology in 1884, he joined the teaching staff of that institution and when he relinquished his academic duties in 1906 he was holding the chair of experimental mechanics and engineering physics. From 1900 to 1906 he was also in charge of the Carnegie Laboratory of Engineering.

Dr. Jacobus is the author of numerous scientific papers on steam engineering subjects, many of which have been included in the transactions of the engineering societies of this country and many published in engineering periodicals. He is a past-president of the American Society of Mechanical Engineers and a member of the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the Society for the Promotion of Engineering Education and of other technical societies.

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I. R. Kelso, a vice-president and general counsel for the Community Power & Light Company, St. Louis, has resigned as vice-president. Mr. Kelso has been active in the utilities field for approximately twenty years. As general counsel for the company he has managed its legal affairs in Arkansas, Missouri, Kansas, New Mexico and Texas.

Howard H. Weber has been appointed assistant manger of wire sales for United States Rubber Products, Inc., with headquarters in New York. Since 1930 he has been director of low-tension

engineering with the General Cable Corporation. Prior to that he was supervising engineer for the Rome Wire Company of Rome, N. Y.; engineer and inspector for the New York Fire Insurance rating organization and engineer for the Utica Gas & Electric Company.

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G. H. Bucher New President Westinghouse International

George H. Bucher has been elected president of the Westinghouse Electric International Company. For the past two years he has been vice-president and general manager. Mr. Bucher joined the Westinghouse Electric & Manufacturing Company, East Pittsburgh, in 1909 as a graduate student. In 1911 he

was transferred to the export department at New York and nine years later was appointed assistant to the general manager of the Westinghouse Electric International Company. One year later he became assistant general manager. As president and general manager Mr. Bucher will continue his headquarters in New York.

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Fred W. Rea has announced his entry into the advertising agency field with offices in San Francisco. For the past 23 years he has been engaged in advertising and sales promotion work for the General Electric Company and subsidiary organizations.

George A. Davis, vice-president of the Oklahoma Gas & Electric Company in charge of public relations, has been elected a member of the board of the public relations division of the Oklahoma Utilities Association for a two-year term to fill a vacancy.

F. I. Lawson has joined the Braden Copper Company at Rancagua, Chili. He was formerly connected with the hydro-electric and transmission department of the Pacific Gas & Electric Company.

Thomas M. Keiller has been appointed superintendent of distribution of the El Paso (Tex.) Electric Company to succeed the late J. E. Jordan. Since 1930 Mr. Keiller had been assistant superintendent of transmission and distribution of the Louisiana division of the Gulf States Utilities Company, Lake Charles. He has been affiliated with the Stone & Webster interests since 1922, when he started with the Houston Electric Company.

Ralph H. Flynn has joined the advertising department of the San Joaquin Light & Power Corporation at Fresno. For three years he was news editor of *Electrical West,* a McGraw-Hill publication, and later a member of the sales organization of the Pacific Gas & Electric Company in the San Joaquin division.

Albert S. Low has been appointed vice-president and chief engineer of the Austin Company, engineers and builders, with headquarters in Cleveland. Mr. Low has been with this company for a period of 21 years and has been active in all branches of the company's work in this country and also in Canada and Mexico.

Otto Brunenmeister, Jr., has been named assistant comptroller of the Commonwealth & Southern Corporation. Like G. H. Bourne, whom he succeeds, Mr. Brunenmeister started with a predecessor company of Commonwealth & Southern.

A. J. Baragiolo of St. Louis has been named chief accountant for the Missouri State Public Service Commission. He fills the vacancy caused by the recent resignation of Harold W. Ross. Mr. Baragiolo has been on the accounting staff of the Missouri commission since 1928 and prior to that was an accountant for the Interstate Commerce Commission.

A. M. Chitty, formerly manager of the southwestern district of the Puget Sound Power & Light Company at Olympia, has been appointed western district manager at Bremerton. He replaces A. S. J. Steele, who will become suburban manager in King County, in Seattle. C. C. Curtis, division manager of the southern division at Olympia, will also take over the work formerly handled by Mr. Chitty.

George H. Blake, general solicitor of Public Service Corporation of New Jersey and subsidiary companies, has been elected a director of the corporation. He will serve the unexpired term of the late Gen. William C. Heppenheimer. Mr. Blake has been in the employ of Public Service since 1910, when he became trial attorney for the company in Jersey City. He was made assistant general solicitor in 1921 and general solicitor in 1923.

B. H. Parkinson has been appointed commercial manager for the Portland Gas & Coke Company. For many years he was connected with the accounting department of the Pacific Power & Light Company and the Northwestern Electric Company, Portland, and recently office manager for these companies and Portland Gas & Coke Company. In transferring his interest from electrical accounting to gas sales, Mr. Parkinson relinquishes his activity in the Accounting Section of the Northwestern Electric Power Association.

OBITUARY

W. I. Middleton

W. Irving Middleton, one of the best-known specialists in insulation engineering in the manufacturing field, died at Watertown, Mass., April 27, after a long period of ill health. Mr. Middleton had retired two years ago from the position of chief electrical engineer of the Simplex Wire & Cable Company. He spent 29 years in the service of the Simplex organization, attaining a notable reputation for original contributions to the art of cable manufacture and ap-

plication. During his administration the company's new high-tension laboratory was built at Cambridge. His early experience was obtained with the General Electric, Westinghouse and Chase-Shawmut companies as a construction and installation engineer.

Mr. Middleton was a founder of the Insulated Power Cable Engineers Association. He was active on the American Engineering Standards Committee and in the National Electric Light Association. He was also a member of the American Institute of Electrical Engineers and had written many papers for that body and for the technical press.

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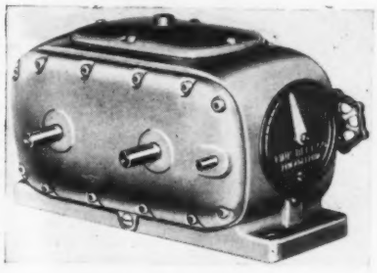
Harry W. Bliven, for many years vice-president and general sales manager of Harvey Hubbell, Inc., manufacturer of electrical equipment of Bridgeport, Conn., died in Yonkers, N. Y., April 27. Mr. Bliven had been associated with the Harvey Hubbell organization for almost 30 years.

Philip J. Aaron, district manager for the Westinghouse Electric Supply Company, Seattle, died recently in that city, after an illness of three months. Following graduation from the University of Illinois, he became associated with the Western Electric Company in Chicago. Later he went to Seattle to establish a Western Electric branch office. In 1913 he was appointed manager of the Fobes Supply Company, which subsequently was absorbed by the Westinghouse company. Mr. Aaron was 62 years of age.

NEW EQUIPMENT

Fractional-Horsepower Transmission Units

Self-adjusting, positive, variable-speed transmissions for fractional-horsepower duty are announced by the Link-Belt Company, Chicago. These transmissions, called the Link-Belt type VRD, are capable of an output of ½ hp. at maximum speed with a maximum speed ratio of 10 to 1 variation. They are of



Transmission—Link-Belt Co.

compact, all-metal construction, totally inclosed and self-lubricating and use a chain for transmitting the power positively.

The VRD units are furnished with horizontal or vertical box, with or without reduction gearing. They can also be supplied motorized with the motor forming an integral part of the unit.

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Class I Welds in Any Position

General-purpose welding electrodes, designated as Type W-22, have been announced by the General Electric Company, Schenectady. They may be used in any position and still have sufficient penetrating properties. These electrodes are of the heavily coated or shielded-arc type and produce welds of the quality required for Class I pressure vessels, according to the A.S.M.E. Boiler Construction Code. Average results on all-weld-metal specimens made from Type W-22 electrodes show average tensile strength from 65,000 to 75,000 lb. per sq.in., 20 to 30 per cent elongation in 2 in. and impact resistance from 30 to 45 ft.-lb. The ability to make Class I position welds without excessive positioning costs will be a distinct advantage to the user.

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Meter bodies for electric flow meters have been introduced by Brown Instrument Company, Philadelphia, Pa. They are designed for measuring the flow of any liquid, vapor or gas creating a differential pressure across an orifice of 1.6 to 16 inches of mercury. Both low and high pressure chambers and connecting "U" tube are designed and sealed to prevent mercury escape even under overload or reverse flow conditions. There are no pressure bearings to leak, no gears, links or chains to wear or break, and no electric contacts to foul in mercury. A float in the high pressure chamber follows the mercury level and its movement is transmitted electrically to the indicating or recording meter by the inductance bridge principle. The range of these meter bodies can be quickly changed by interchanging range tubes, of which there are nine.

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Continuous Reading Vacuum Gage of Electric Type

An improved model of its No. 6 Tru-Vac vacuum gage has been announced by the Continental Electric Company, St. Charles, Ill. The gage is an advantage over the mercury type of gage where accurate and dependable knowledge of vacuum is required. The gage consists of a unit box containing a four-element bridge, two arms of which are fixed resistors and two are glass bulbs containing filaments. A meter box is used which supplies constant current from a 4 volt source by means of a resistance and an ammeter, and measures the degree of bridge unbalance with a millivolt meter. One glass bulb is at atmospheric pressure, the other in the vacuum. The bridge is balanced if the vacuum is perfect and becomes unbalanced if the pressure in the vacuum element rises, because of increased heat conduction from the filament.

Instantaneous and continuous readings are obtained and changes indicated when they occur. Dials are calibrated in microns and readings of extremely small fractions may be secured.

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Small Commercial Floodlights

Floodlights—
S. & M. Lamp Co.

For use in small show windows, yards, garages, signs, etc., "Red Cap Floodlites" No. 400 and No. 402, have just been announced by the S & M Lamp Company, Los Angeles. The units are constructed of oxidized aluminum with the same care and precision as the larger, more expensive types. They are designed with a reflector bowl 7 in. in diameter and a beam spread of 120 deg. Clear lamps are used, 100 watt, and according to the manufacturer an extremely even area of illumination is projected without streaks or shadows. The No. 400 has a porcelain socket and two-piece cast aluminum cap with fitting for ½-in. conduit mounting. No. 402 is equipped with adjustable bracket and 4 ft. of weatherproof cord and plug.

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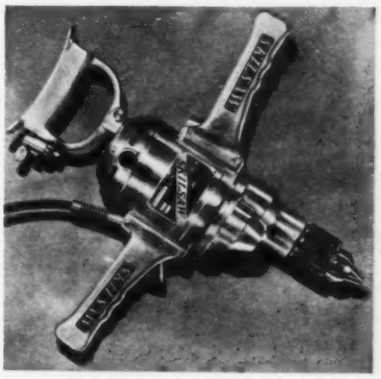
Portable Electric Drills Added

Portable electric drills in sizes from ¼ to ½ in. have been announced by Skilsaw, Inc., Chicago. They are designed for operating convenience, longer life



Electric Drill—Skilsaw, Inc.

and higher efficiencies than former tools of this type. The drills are driven by universal a.c. or d.c. motors with balanced armatures. The motors are cooled by a balance fan mounted on the armature shaft. Bodies are of die-cast aluminum alloy for strength with reduced weight. They offer a dense surface to which grease does not readily adhere. All exposed steel parts are processed to avoid rusting. Standard cord equipment includes three-conductor, rubber-insulated copper lead-in cord of convenient length, securely clamped to the handle of the drills and protected by a spring wire guard. Ground connection integral with cord provides safety.

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Chain Stoker Redesigned

Combustion Engineering Company, 200 Madison Avenue, New York City, has built a frame construction into the modified Green natural draft chain grate stoker. This will provide for fixed attachment of controls and be capable of coping with expansion and simple conversion to forced draft if desired. Instead of a cast-iron frame supported on wheels, as formerly employed, the new design, designated as the "KS," has a stationary structure, fixed into the setting. This consists of transverse channels supported on posts at either side, to which, in turn, are fastened angles parallel to the side walls. Skids supported on I-beams carry the weight of the chain at the bottom.

A pipe, flush with the side wall, and extending nearly the length of the stoker, carries the adjusting rod and takes the tension off the frame. While the take-up in the tension of the chain is at the rear, the actual adjustment is

at the front, which is always accessible. With natural draft, zone control may be applied, if desired, by placing louver dampers between the channels in one or more compartments. Conversion to forced draft can be readily accomplished by substituting forced draft links, adding dampers and installing an internal seal and hood at the front.

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Fire Extinguishers With Isolated Pumps

Wil-X Manufacturing Corporation, 29 Ryerson Street, Brooklyn, has announced fire extinguishers with the pump outside the cylindrical container. These extinguishers, identified as the Wilbur

Extinguisher—Wil-X Mfg. Corp.

model, after the inventor, Peter L. Wilbur, who, it is said, created the Pyrene model, will not jam, gum up or corrode because the pump never comes in contact with the liquid. This assures convenient operation and longer life.

The pump and nozzle fold down alongside the cylinder when not in use. In action the pump is raised quickly, which instantaneously opens the positive sealing valves and the spray is directed in "machine gun" fashion at the base of the flames. When the pump is again lowered the valves close and save the remaining liquid.

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Rubber-insulated "Thiokol" sheathed portable cord has been announced by the General Cable Corporation, New York City. Thiokol is a rubber-like material impervious to oil and gasoline and when applied as a sheathing to rubber insulation makes an oil-proof cable that will last longer and will not become swollen, soft and sticky like plain rubber insulation when oil-soaked.

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Automatic electric sump pumps and cellar drainers with improved features have been announced by the M. L. Oberdorfer Brass Company, Syracuse, N. Y., and are identified as model B-2400. This new unit is constructed of bronze and has a special ½-hp., 1,725-r.p.m. (110-volt, 60 cycle) induction type motor. The manufacturer states that the unit is rust-proof, quiet-running and is considered to be trouble-proof. Its performance will not give radio reception interference, no matter what speed it is running at. The pump is an all bronze unit of centrifugal design with open type impeller to allow passing of solids and is automatic in operation.

Tests of the sump pump prove it capable of pumping 2,400 gal. per hour at 1-ft. head and up to 400 gal. at 20-ft. head. The outlet is tapped for 1-in. fittings for easy connection to pipe or hose line. There is a plug and 8 ft. of cord supplied and installation is completed by merely connecting pipe line and plugging the cord in any outlet.

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For Cash Protection

Two money protecting units are just announced by the Meilink Steel Safe Company of Toledo. One is the Meilink delayed control money locker and the other the Meilink "Electrolock" remote-control cash drawer. Both use electricity from any light socket.

The first and larger unit is designed to safeguard bulk cash until it can be banked or safely disposed of in collection offices or bank cages. An electric time delay is placed in the regular combination lock such that when the combination is set to open it, the door cannot be opened for fifteen minutes. The remote-control drawer is one of heavily welded construction with reinforced front to prevent forcing. It is provided with an electric relay interlock so that it cannot be opened once the relay is set until a key is brought from some remote point.

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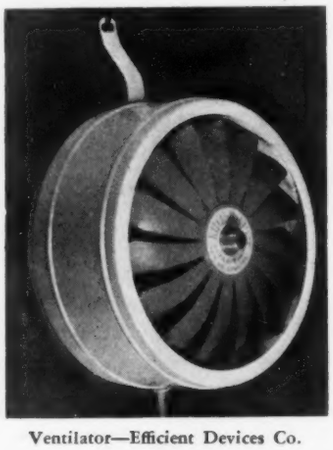
Simple Kitchen Ventilator

Kitchen ventilators of improved design for easy installation have been announced by the Efficient Devices Company, 1461 Calvert Avenue, Detroit. These devices are not window ventila-



Ventilator—Efficient Devices Co.

tors but are called "Kitch-O-Vent," designed to be hung over the opening of the stove pipe flue which is found in almost every kitchen and to assist the natural draft of the flue. There is no installation cost as the connection is simply plugged into the nearest electrical outlet. The units are available for 110-volt a.c. service; rated at 25 volts.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

THE DORECO HEATING ELEMENT, two-page leaflet of the Cooley Electric Furnace Company, 433 North Capital Avenue, Indianapolis, Ind., April, 1934. Describes and illustrates the Doreco heating element used in Cooley Bluefield furnaces, which are also available as a renewal unit for all types of laboratory furnace equipment.

ELECTRICAL EQUIPMENT FOR RAILROADS, Catalog 1966 of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., 60 pages, March, 1934. Catalog describes electrical equipment for railroad shops and maintenance of way, such as arc welding equipment, heat treating and melting apparatus, motors, controls, lighting battery charging, etc.

CONSTRUCTION AND TEST OF ELECTRIC PORTABLE LIGHTING DEVICES, approved as Canadian standard by the Canadian Engineering Standards Association, 1934; C.E.S.A. Specification No. 12, 12 pages, March, 1934. Available from the association at Ottawa. Price 25 cents.

WORTHINGTON SURFACE CONDENSERS of the patented folded tube layer type. Leaflet W-200-B2 of the Worthington Pump and Machinery Corporation, Harrison, N. J., three pages. Description, sectional drawings and dimensions of Worthington folded tube layer type welded steel shell design.

SILICON-CARBIDE SUPER-REFRACTORIES for lining boiler and industrial furnaces, kilns, retorts, muffles, etc., Catalog No. 232 of the General Refractories Company, Philadelphia, 8 pages. Physical characteristics, types and sizes of Carbex brick and tile, tubes, saggers, baffles, shapes, etc., together with sketches and illustrations showing where they should be used, and how to apply them.

SAVINGS EFFECTED BY BAILEY BOILER METERS, Bulletin No. 44-A of the Bailey Meter Company, Cleveland, 32 pages, March, 1934. Includes actual plant and operating data showing the nature and amount of savings effected in over 20 typical installations of Bailey boiler meters which cover a wide range of fuels, methods of firing, types and boiler sizes.

HARVEL OIL STOP for the Electrical Trade, bulletin of Irvington Varnish & Insulator Co., Irvington, N. J., 8 pages. The electrical and other properties of Harvel Oil Stop and where and how it should be used for different splices, cable terminals, etc. A brief description of Rubber Splice is included, which is Oil Stop with long fiber asbestos added for splicing rubber-insulation without tape.

MICABOND, a bonded mica insulating material, booklet of the Continental-Diamond Fibre Co., Newark, Del. The properties, sizes, uses and specifications of Micabond, sheets, plates, tubing, cloth and tapes, together with some machining hints. Brief descriptions of other Continental-Diamond products are given.

Table I—Data on Output and Peak
in No

Public utility, lighting, power and electric railway syst

Line No.	Company or System*	1933						
		Rank in 1933	System Peak Load (30-Minute) Incl. Purchased Energy Kw. (See Note *a*)	Peak Load on Generator Stations (30-Minute) Kw. (See Note *a*)	Output for Year (Including Purchased Energy) Kw.-Hr.	Average Load in Kw.	System Peak Lo (30-Minu Incl. Purch Energy Kw. (See Note
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	United States						
1	Niagara Hudson Power Corporation System (*C*)	1	1,046,700	(*o*) 823,300	5,968,613,505	681,300	(*o*) 923,
2	Consolidated Gas Co. of N. Y. System Elec. Affiliates* (*H*)	2	1,176,000	1,104,000	5,015,100,000	572,500	1,189,
3	Pacific Gas & Electric Company	3	754,800	.....	4,048,123,590	462,000	728,
4	Commonwealth Edison Company	4	885,000	504,750	3,801,321,000	434,000	(*b*) 855,
5	Philadelphia Electric Company System	5	.....	619,000	2,946,680,745	336,500	.....
6	Southern California Edison Company Ltd	6	508,700	506,800	2,772,640,491	316,500	516,
7	Public Service Electric & Gas Company (N. J.)	7	488,900	463,250	2,038,096,250	232,500	456,
8	New England Power Association (Consolidated) System	8	(*o*) 451,900	.....	2,011,436,299	229,600	(*o*) 467,
9	The Detroit Edison Company	9	.....	415,200	1,908,671,712	217,900	420,
10	The Ohio Power Company	10	367,000	367,000	1,804,853,938	206,000	289,
11	Duke Power Company	11	403,100	300,000	1,765,737,132	201,500	405,
12	The North American Co. Sys. (Mo. Ill and Iowa Group)	12	318,390	.....	1,696,604,927	193,700	329,
13	The West Penn Electric Company Subsidiaries	13	(*o*) 306,061	(*o*) 305,501	1,657,437,659	189,200	(*o*) 260,
14	Alabama Power Company	14	(*o*) 390,720	.....	1,601,049,505	182,800	389,
15	Public Service Company of Northern Illinois	15	180,144	(*j*) 218,960	1,519,982,344	173,500	173,
16	Pennsylvania Power & Light Company	16	(*o*) 280,100	(*o*) 198,940	1,402,223,178	160,000	(*o*) 281,
17	Appalachian Electric Power Company (*E*)	17	239,270	206,000	1,335,577,926	152,400	207,
18	Pennsylvania Wtr. & Pwr. Co. and Safe Harbor Wtr. Pwr. Corp. (*f*)	18	(*o*) 256,800	(*o*) 256,800	1,314,265,000	150,000	(*o*) 222,
19	Georgia Power Company	19	(*o*) 284,860	.....	1,252,193,279	143,000	(*o*) 275,
20	Super-Power Company of Illinois	20	227,400	222,000	1,246,053,446	142,000	237,
21	The Cleveland Electric Illuminating Company	21	309,392	.....	1,240,542,167	141,600	283,
22	Duquesne Light Company	22	264,000	264,000	1,211,956,122	138,400	245,
23	The Edison Electric Illuminating Company of Boston	23	283,595	219,000	1,073,311,339	122,400	265,
24	Columbia Gas & Electric Corporation System	24	261,000	.....	1,045,236,270	119,300	249,
25	Chicago District Electric Generating Corporation	25	193,128	193,128	1,042,475,756	119,000	190,
26	The North American Co. System (Wis., Michigan Group)	26	221,693	.....	974,871,307	111,300	231,
27	Carolina Power & Light Company	27	(*o*) 234,250	(*o*) 170,920	966,328,322	110,300	(*o*) 208,
28	Northern States Power Company (Del.) Subsidiaries	28	.....	.....	963,928,433	110,000	204,
29	Consumers Power Company	29	(*o*) 210,467	.....	928,828,246	106,000	237,
30	Consolidated Gas Electric Light & Power Co. of Baltimore	30	(*e*) 198,000	(*o*) 74,200	(*g*) 897,675,028	102,500	(*o*) 180,
31	The Montana Power Company	31	159,600	159,600	889,321,000	101,500	119,
32	Puget Sound Power & Light Company	32	179,795	170,295	788,481,852	90,000	177,
33	Ohio Edison Company	33	(*o*) 145,200	.....	715,770,350	81,700	(*o*) 153,
34	Assoc. Gas & Elec. System (Eastern Pa. & N. J. Group) (*c*)	34	(*o*) 147,900	(*o*) 138,300	713,137,805	81,400	(*o*) 143,
35	City of Los Angeles, Bureau of Power & Light	35	159,600	95,500	712,102,112	81,300	167,
36	The Washington Water Power Company	36	118,785	118,785	634,984,182	72,500	128,
37	Kansas City Power & Light Company	37	.....	120,600	596,988,080	68,200	128,
38	The Tennessee Electric Power Company	38	(*o*) 110,300	.....	575,047,467	65,640	145,
39	The North American Co. System (District of Columbia Group)	39	148,000	.....	562,432,866	64,200	137,
40	The Connecticut Electric Service Company System	40	(*o*) 116,719	.....	557,824,571	63,700	(*o*) 114,
41	Public Service Company of Indiana (*L*)	41	118,450	100,300	530,805,379	60,600	116,
42	Louisiana Power & Light Company	42	110,188	97,000	530,645,000	60,600	112,
43	Virginia Electric & Power Company	43	102,400	92,000	506,712,794	57,800	104,
44	Portland General Electric Company	44	(*o*) 109,000	(*o*) 109,000	496,188,200	56,600	(*o*) 108,
45	Texas Power & Light Company	45	(*o*) 101,630	(*o*) 82,240	482,671,000	55,100	(*o*) 102,
46	The California Oregon Power Company	46	83,565	80,800	478,306,895	54,600	84,
47	Utah Power & Light Company	47	90,710	66,340	476,411,537	54,400	103,
48	Hetch Hetchy Water Supply (San Francisco)	48	84,600	84,600	469,418,170	53,600	83,
49	Assoc. Gas & Elec. System (South Carolina Group) (*h*)	49	(*o*) 131,000	(*o*) 131,000	463,031,379	52,800	(*o*) 117,
50	Illinois Power & Light Corporation (Illinois)	50	97,500	.....	458,656,166	52,400	99,
51	Houston Lighting & Power Company	51	83,000	80,900	442,468,000	50,500	(*o*) 82,
52	Indiana & Michigan Electric Company	52	105,000	61,890	441,374,426	50,380	110,
53	N. Y. State Elec. & Gas Corp. Group (Assoc. G. & E. System)	53	(*o*) 101,730	(*o*) 49,188	437,172,115	49,900	(*o*) 74,
54	Oklahoma Gas & Electric Company	54	83,678	80,178	429,121,897	49,000	83,
55	Toledo Edison Company	55	(*o*) 87,000	(*o*) 86,792	412,111,501	47,000	(*o*) 95,
56	Western Massachusetts Companies System	56	74,800	.....	412,011,000	47,000	76,
57	Ohio Public Service Company	57	(*o*) 95,900	(*o*) 63,700	408,607,809	46,600	(*o*) 90,
58	Monongahela Electric Company	58	100,800	73,860	407,000,000	46,500	91,

Supplement to ELECTRICAL WORLD, May 5, 1934
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ak Load of Largest Generating and Dist
North America, 1927—1933

systems in the United States, Canada and Mexico having output in excess of 100,000,000 kw.-hr. during 1933 or earlier year

1932				1931				1930		1929	
ystem k Load Minute) Purchased nergy Kw. Note *a*) (8)	Peak Load on Generator Stations (30-Minute) Kw. (See Note *a*) (9)	Output for Year (Including Purchased Energy) Kw.-Hr. (10)	Average Load in Kw. (11)	System Peak Load (30-Minute) Incl. Purchased energy Kw. (See Note *a*) (12)	Peak Load on Generator Stations (30-Minute) Kw. (See Note *a*) (13)	Output for Year (Including Purchased Energy) Kw.-Hr. (14)	Average Load in Kw. (15)	System Peak Load (Over 30-Minute Period) Kw. (See Note *a*) (16)	Output for Year (Including Purchased Energy) Kw.-Hr. (17)	System Peak Load (Over 30-Minute Period) Kw. (See Note *a*) (18)	Outpu for Ye (Includi Purchas Energy Kw.-H (19)
923,368	(*o*) 796,400	5,378,434,187	613,000	998,876	850,218	5,911,409,390	675,000	1,091,910	6,892,316,698	(*m*) 1,148,600	7,212,743
,189,400	1,189,400	4,981,200,000	567,500	1,240,000	1,240,000	5,138,200,000	586,000	1,226,000	4,983,500,000	1,209,000	4,678,700
728,900	.....	4,004,245,763	456,000	855,500	.....	4,558,552,038	520,000	853,300	4,546,499,302	(*m*) 513,800	2,717,874
855,000	537,000	3,686,443,000	420,000	(*b*) 902,500	616,550	4,226,257,000	482,000	969,800	4,582,510,000	1,000,200	4,636,434
.....	626,000	2,860,721,532	325,800	.....	668,000	3,032,323,879	346,000	(*G*) 670,000	3,091,233,131	(*G*) 713,000	3,029,885
516,500	514,400	2,856,602,851	325,000	558,200	554,900	3,061,836,977	349,500	(*m*) 582,900	3,168,973,397	(*m*) 571,000	3,162,988
456,100	373,850	2,037,604,869	232,000	462,700	366,500	2,170,512,600	247,860	506,500	2,173,944,354	517,225	2,134,581
467,300	.....	2,032,576,325	231,500	(*o*) 484,000	.....	1,987,327,572	226,800	411,000	1,590,215,715	395,000	1,703,536
420,300	.....	1,851,223,900	210,800	477,700	.....	2,170,254,600	247,700	526,800	2,384,528,500	547,600	2,654,901
289,250	289,250	1,399,680,283	159,500	242,000	326,000	1,456,252,361	166,200	(*m*) 262,000	1,479,180,000	(*m*) 276,000	1,544,252
405,400	334,300	1,649,582,952	187,900	412,000	322,000	1,768,184,411	201,800	421,000	1,762,798,306	432,000	1,981,239
329,506	.....	1,650,408,229	188,000	384,324	.....	1,868,194,882	213,000	(*m*) 370,072	1,954,460,032	(*m*) 350,000	1,871,797
260,971	.....	1,457,715,339	166,000	(*o*) 306,845	.....	1,693,855,089	193,300	345,720	1,875,470,490	362,787	1,938,955
389,120	343,400	1,406,939,956	160,200	(*o*) 402,810	.....	1,860,805,943	212,500	416,750	1,707,945,749	376,400	1,715,250
173,470	(*j*) 223,476	1,331,986,990	151,700	191,661	(*j*) 195,545	1,361,938,056	155,500	186,869	1,361,763,671	190,123	1,246,330
281,600	(*o*) 229,200	1,382,587,998	157,400	(*o*) 291,600	(*o*) 231,200	1,483,177,247	169,300	298,500	1,443,264,200	285,800	1,251,104
207,680	166,130	1,135,486,426	129,300	231,730	234,000	1,276,642,108	145,700	(*m*) 280,600	1,613,396,000	(*m*) 265,000	1,484,761
222,100	(*o*) 222,100	933,430,500	106,400	(*o*) 126,500	(*o*) 126,500	506,218,600	57,800	127,900	527,694,000	129,600	610,962
275,660	(*o*) 268,170	1,163,107,611	132,500	270,000	.....	1,319,011,309	150,600	301,955	1,364,739,226	257,125	1,146,516
237,600	223,000	1,232,552,866	140,400	236,700	231,800	1,253,830,208	143,100	158,400	729,805,500	.....	.....
283,900	.....	1,201,175,042	136,900	309,556	.....	1,316,116,027	150,200	(*m*) 323,367	1,370,467,732	(*m*) 315,870	1,447,193
245,000	245,000	1,176,868,998	134,000	289,000	289,000	1,364,318,513	155,800	304,000	1,510,950,299	.....	1,573,445
265,563	213,000	1,048,824,142	119,400	281,787	231,210	1,048,605,842	119,700	(*m*) 289,017	1,073,796,288	(*m*) 275,501	1,041,388
249,900	.....	1,072,227,180	123,100	266,540	.....	1,162,409,020	132,700	262,000	1,161,459,375	261,000	1,203,652
190,848	190,848	940,504,000	107,200	191,232	191,232	1,009,506,000	115,200	198,324	1,039,422,000	163,900	(*l*) 430,779
231,969	.....	971,760,512	110,700	261,322	.....	1,125,840,103	128,500	(*m*) 276,586	1,243,228,676	(*m*) 284,359	1,311,738
208,600	(*o*) 178,750	814,270,505	92,700	(*o*) 217,000	(*o*) 171,300	731,648,290	83,500	188,000	564,056,174	108,000	476,878
204,461	.....	974,484,310	111,000	227,971	.....	1,064,002,895	121,500	210,000	1,024,205,047	.....	969,071
237,343	197,592	894,759,956	101,800	242,700	.....	1,016,384,395	116,000	248,000	1,072,090,387	270,772	1,198,947
180,400	(*o*) 119,900	843,522,718	96,000	(*o*) 181,500	(*o*) 162,500	884,250,577	100,900	188,200	933,093,920	186,000	910,934
119,700	119,700	613,026,278	69,800	145,700	145,700	937,014,000	107,000	216,000	1,293,449,000	229,800	1,611,521
177,255	148,763	824,481,187	93,800	185,630	.....	911,955,295	104,100	192,623	980,325,415	(*m*) 193,392	941,992
153,000	(*o*) 134,700	693,551,026	79,000	.....	.....	849,713,467	96,900	.....	980,578,309	.....	.....
143,860	(*o*) 125,590	664,678,386	75,600	(*o*) 151,870	(*o*) 151,870	706,351,308	80,600	158,140	725,194,632	158,320	735,612
167,400	94,500	722,331,128	82,200	169,000	84,700	759,028,656	86,600	170,000	759,852,996	161,000	722,998
128,135	128,135	647,596,251	73,700	(*o*) 152,420	(*o*) 152,420	784,134,417	89,500	155,960	850,025,000	172,735	858,353
128,200	.....	615,730,828	70,100	131,000	.....	629,935,369	71,900	136,200	647,940,872	132,400	645,165
145,740	106,260	536,913,727	61,100	165,000	.....	762,528,751	87,000	150,965	783,433,211	157,600	819,723
137,000	137,000	542,527,569	61,750	130,000	130,000	519,295,192	59,300	(*m*) 123,000	488,533,981	118,000	449,794
114,425	.....	536,775,777	61,100	(*o*) 115,241	.....	552,059,756	63,000	115,629	568,625,609	123,915	580,426
116,980	.....	533,569,196	60,800	72,588	40,775	320,594,122	36,600	.....	.....	.....	.....
112,988	103,000	551,155,000	62,700	112,091	96,151	612,119,000	69,900	108,361	596,413,000	110,464	511,225
104,200	97,500	507,496,464	57,750	107,600	.....	534,628,983	61,000	108,100	514,453,563	101,800	480,970
108,300	(*o*) 126,000	514,789,600	58,500	(*o*) 130,900	(*o*) 130,400	603,182,100	68,800	128,000	589,240,400	123,600	603,423
102,540	(*o*) 82,630	435,440,000	49,550	(*o*) 105,225	(*o*) 89,890	445,325,000	50,800	98,405	440,721,000	102,780	442,818
84,700	81,795	471,471,767	53,700	92,425	81,760	465,156,805	53,100	(*m*) 83,540	476,173,234	(*m*) 94,575	410,083
103,710	67,160	493,678,000	56,200	119,390	100,500	650,549,000	74,300	(*m*) 135,405	746,475,000	142,505	882,360
83,600	83,600	507,323,840	57,700	83,600	83,600	309,450,010	35,300	83,600	493,888,420	83,400	464,339
117,700	(*o*) 117,700	397,764,719	45,250	(*o*) 123,900	(*o*) 123,900	425,907,556	48,600	65,100	178,976,937	53,200	162,129
99,000	.....	458,872,819	52,360	99,000	.....	506,145,010	57,800	102,050	533,762,511	108,300	542,629
82,600	(*o*) 79,500	435,971,000	49,600	(*o*) 96,210	(*o*) 93,100	524,913,000	59,900	103,900	566,409,000	96,205	510,247
110,500	87,620	408,462,952	46,600	126,160	95,620	491,439,695	56,100	(*m*) 120,860	530,316,000	(*m*) 106,190	538,734
74,500	(*o*) 38,000	412,760,797	47,000	(*o*) 89,500	(*o*) 33,500	430,009,374	49,100	.....	444,904,828	.....	377,746
83,152	.....	430,351,857	49,000	99,494	95,530	489,174,640	55,800	114,500	643,486,718	.....	692,070
95,400	(*o*) 81,000	389,779,858	44,350	(*o*) 107,030	(*o*) 95,000	452,178,712	51,600	123,230	468,679,050	123,700	514,989
76,700	.....	433,146,000	49,300	86,100	85,100	443,000,000	50,500	93,100	476,000,000	105,100	494,805
90,300	(*o*) 56,200	395,239,555	45,000	(*o*) 103,200	(*o*) 71,000	455,840,667	52,000	118,300	553,277,582	114,900	611,482

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Output and Peak Load of Largest Gene in North America, 1927—19

Public utility, lighting, power and electric railway systems in the United States, Canada and Mexico having output in excess of

1933				1932				1931			
System Peak Load (30-Minute) Incl. Purchased Energy Kw. (See Note *a*) (4)	Peak Load on Generator Stations (30-Minute) Kw. (See Note *a*) (5)	Output for Year (Including Purchased Energy) Kw.-Hr. (6)	Average Load in Kw. (7)	System Peak Load (30-Minute) Incl. Purchased Energy Kw. (See Note *a*) (8)	Peak Load on Generator Stations (30-Minute) Kw. (See Note *a*) (9)	Output for Year (Including Purchased Energy) Kw.-Hr. (10)	Average Load in Kw. (11)	System Peak Load (30-Minute) Incl. Purchased energy Kw. (See Note *a*) (12)	Peak Load on Generator Stations (30-Minute) Kw. (See Note *a*) (13)	Output for Year (Including Purchased Energy) Kw.-Hr. (14)	
1,046,700	(*o*) 823,300	5,968,613,505	681,300	(*o*) 923,368	(*o*) 796,400	5,378,434,187	613,000	998,876	850,218	5,911,409,390	
1,176,000	1,104,000	5,015,100,000	572,500	1,189,400	1,189,400	4,981,200,000	567,500	1,240,000	1,240,000	5,138,200,000	
754,800	.....	4,048,123,590	462,000	728,900	.....	4,004,245,763	456,000	855,500	.....	4,558,552,038	
885,000	504,750	3,801,321,000	434,000	(*b*) 855,000	537,000	3,686,443,000	420,000	(*b*) 902,500	616,550	4,226,257,000	
.....	619,000	2,946,680,745	336,500	.....	626,000	2,860,721,532	325,800	.....	668,000	3,032,323,879	
508,700	506,800	2,772,640,491	316,500	516,500	514,400	2,856,602,851	325,000	558,200	554,900	3,061,836,977	
488,900	463,250	2,038,096,250	232,500	456,100	373,850	2,037,604,869	232,000	462,700	366,500	2,170,512,600	
(*o*) 451,900	.....	2,011,436,299	229,600	(*o*) 467,300	.....	2,032,576,325	231,500	(*o*) 484,000	.....	1,987,327,572	
.....	415,200	1,908,671,712	217,900	420,300	.....	1,851,223,900	210,800	477,700	.....	2,170,254,600	
367,000	367,000	1,804,853,938	206,000	289,250	289,250	1,399,680,283	159,500	242,000	326,000	1,456,252,361	
403,100	300,000	1,765,737,132	201,500	405,400	334,300	1,649,582,952	187,900	412,000	322,000	1,768,184,411	
318,390	.....	1,696,604,927	193,700	329,506	.....	1,650,408,229	188,000	384,324	.....	1,868,194,882	
(*o*) 306,061	(*o*) 305,501	1,657,437,659	189,200	(*o*) 260,971	.....	1,457,715,339	166,000	(*o*) 306,845	.....	1,693,855,089	
(*o*) 390,720	.....	1,601,049,505	182,800	389,120	343,400	1,406,939,956	160,200	(*o*) 402,810	.....	1,860,805,943	
180,144	(*j*) 218,960	1,519,982,344	173,500	173,470	(*j*) 223,476	1,331,986,990	151,700	191,661	(*j*) 195,545	1,361,938,056	
(*o*) 280,100	(*o*) 198,940	1,402,223,178	160,000	(*o*) 281,600	(*o*) 229,200	1,382,587,998	157,400	(*o*) 291,600	(*o*) 231,200	1,483,177,247	
239,270	206,000	1,335,577,926	152,400	207,680	166,130	1,135,486,426	129,300	231,730	234,000	1,276,642,108	
(*o*) 256,800	(*o*) 256,800	1,314,265,000	150,000	(*o*) 222,100	(*o*) 222,100	933,430,500	106,400	(*o*) 126,500	(*o*) 126,500	506,218,600	
(*o*) 284,860	.....	1,252,193,279	143,000	(*o*) 275,660	(*o*) 268,170	1,163,107,611	132,500	270,000	.....	1,319,011,309	
227,400	222,000	1,246,053,446	142,000	237,600	223,000	1,232,552,866	140,400	236,700	231,800	1,253,830,208	
309,392	.....	1,240,542,167	141,600	283,900	.....	1,201,175,042	136,900	309,556	.....	1,316,116,027	
264,000	264,000	1,211,956,122	138,400	245,000	245,000	1,176,868,998	134,000	289,000	289,000	1,364,318,513	
283,595	219,000	1,073,311,339	122,400	265,563	213,000	1,048,824,142	119,400	281,787	231,210	1,048,605,842	
261,000	.....	1,045,236,270	119,300	249,900	.....	1,072,227,180	123,100	266,540	.....	1,162,409,020	
193,128	193,128	1,042,475,756	119,000	190,848	190,848	940,504,000	107,200	191,232	191,232	1,009,506,000	
221,693	.....	974,871,307	111,300	231,969	.....	971,760,512	110,700	261,322	.....	1,125,840,103	
(*o*) 234,250	(*o*) 170,920	966,328,322	110,300	(*o*) 208,600	(*o*) 178,750	814,270,505	92,700	(*o*) 217,000	(*o*) 171,300	731,648,290	
.....	.....	963,928,433	110,000	204,461	.....	974,484,310	111,000	227,971	.....	1,064,002,895	
(*o*) 210,467	.....	928,828,246	106,000	237,343	197,592	894,759,956	101,800	242,700	.....	1,016,384,395	
(*e*) 198,000	(*o*) 74,200	(*g*) 897,675,028	102,500	(*o*) 180,400	(*o*) 119,900	843,522,718	96,000	(*o*) 181,500	(*o*) 162,500	884,250,577	
159,600	159,600	889,321,000	101,500	119,700	119,700	613,026,278	69,800	145,700	145,700	937,014,000	
179,795	170,295	788,481,852	90,000	177,255	148,763	824,481,187	93,800	185,630	.....	911,955,295	
(*o*) 145,200	.....	715,770,350	81,700	(*o*) 153,000	(*o*) 134,700	693,551,026	79,000	.....	.....	849,713,467	
(*o*) 147,900	(*o*) 138,300	713,137,805	81,400	(*o*) 143,860	(*o*) 125,590	664,678,386	75,600	(*o*) 151,870	(*o*) 151,870	706,351,308	
159,600	95,500	712,102,112	81,300	167,400	94,500	722,331,128	82,200	169,000	84,700	759,028,656	
118,785	118,785	634,984,182	72,500	128,135	128,135	647,596,251	73,700	(*o*) 152,420	(*o*) 152,420	784,134,417	
.....	120,600	596,988,080	68,200	128,200	.....	615,730,828	70,100	131,000	.....	629,935,369	
(*o*) 110,300	.....	575,047,467	65,640	145,740	106,260	536,913,727	61,100	165,000	.....	762,528,751	
148,000	.....	562,432,866	64,200	137,000	137,000	542,527,569	61,750	130,000	130,000	519,295,192	
(*o*) 116,719	.....	557,824,571	63,700	(*o*) 114,425	.....	536,775,777	61,100	(*o*) 115,241	.....	552,059,756	
118,450	100,300	530,805,379	60,600	116,980	.....	533,569,196	60,800	72,588	40,775	320,594,122	
110,188	97,000	530,645,000	60,600	112,988	103,000	551,155,000	62,700	112,091	96,151	612,119,000	
102,400	92,000	506,712,794	57,800	104,200	97,500	507,496,464	57,750	107,600	.....	534,628,983	
(*o*) 109,000	(*o*) 109,000	496,188,200	56,600	(*o*) 108,300	(*o*) 126,000	514,789,600	58,500	(*o*) 130,900	(*o*) 130,400	603,182,100	
(*o*) 101,630	(*o*) 82,240	482,671,000	55,100	(*o*) 102,540	(*o*) 82,630	435,440,000	49,550	(*o*) 105,225	(*o*) 89,890	445,325,000	
83,565	80,800	478,306,895	54,600	84,700	81,795	471,471,767	53,700	92,425	81,760	465,156,805	
90,710	66,340	476,411,537	54,400	103,710	67,160	493,678,000	56,200	119,390	100,500	650,549,000	
84,600	84,600	469,418,170	53,600	83,600	83,600	507,323,840	57,700	83,600	83,600	309,450,010	
(*o*) 131,000	(*o*) 131,000	463,031,379	52,800	(*o*) 117,700	(*o*) 117,700	397,764,719	45,250	(*o*) 123,900	(*o*) 123,900	425,907,556	
97,500	.....	458,656,166	52,400	99,000	.....	458,872,819	52,260	99,000	.....	506,145,010	
83,000	80,900	442,468,000	50,500	(*o*) 82,600	(*o*) 79,500	435,971,000	49,600	(*o*) 96,210	(*o*) 93,100	524,913,000	
105,000	61,890	441,374,426	50,380	110,500	87,620	408,462,952	46,600	126,160	95,620	491,439,695	
(*o*) 101,730	(*o*) 49,188	437,172,115	49,900	(*o*) 74,500	(*o*) 38,000	412,760,797	47,000	(*o*) 89,500	(*o*) 33,500	430,009,374	
83,678	80,178	429,121,897	49,000	83,152	.....	430,351,857	49,000	99,494	95,530	489,174,640	
(*o*) 87,000	(*o*) 86,792	412,111,501	47,000	(*o*) 95,400	(*o*) 81,000	389,779,858	44,350	(*o*) 107,030	(*o*) 95,000	452,178,712	
74,800	.....	412,011,000	47,000	76,700	.....	433,146,000	49,300	86,100	85,100	443,000,000	
(*o*) 95,900	(*o*) 63,700	408,607,809	46,600	(*o*) 90,300	(*o*) 56,200	395,239,555	45,000	(*o*) 103,200	(*o*) 71,000	455,840,667	
100,800	77,860	407,000,000	46,500	91,600	77,920	333,403,000	37,960	89,800	77,940	435,364,000	

nerating and Distributing Systems
933

of 100,000,000 kw.-hr. during 1933 or earlier year

	1930		1929		1928		1927		
Average Load in Kw. (15)	System Peak Load (Over 30-Minute Period) Kw. (See Note *a*) (16)	Output for Year (Including Purchased Energy) Kw.-Hr. (17)	System Peak Load (Over 30-Minute Period) Kw. (See Note *a*) (18)	Output for Year (Including Purchased Energy) Kw.-Hr. (19)	System Peak Load (Over 30-Minute Period) Kw. (See Note *a*) (20)	Output for Year (Including Purchased Energy) Kw.-Hr. (21)	System Peak Load (Instantaneous) Kw. (See Note *a*) (22)	Output for Year Including (Purchased Energy) Kw.-Hr. (23)	Line No. (24)
675,000	1,091,910	6,892,316,698	(*m*) 1,148,600	7,212,743,072	.....	.....	.....	.....	1
586,000	1,226,000	4,983,500,000	1,209,000	4,678,700,000	1,125,000	4,210,700,000	784,077	2,877,090,621	2
520,000	853,300	4,546,499,302	(*m*) 513,800	2,717,874,472	(*m*) 484,600	2,545,713,564	439,568	2,322,015,035	3
482,000	969,800	4,582,510,000	1,000,200	4,636,434,000	1,016,000	4,174,661,000	952,000	3,778,380,000	4
346,000	(*G*) 670,000	3,091,233,131	(*G*) 713,000	3,029,885,631	561,400	2,266,856,345	455,000	1,860,613,091	5
349,500	(*m*) 582,900	3,168,973,397	(*m*) 571,000	3,162,988,030	(*m*) 516,100	2,762,459,843	448,900	2,421,357,098	6
247,800	506,500	2,173,944,354	517,225	2,134,581,298	471,000	1,879,024,063	435,500	1,701,886,359	7
226,800	411,000	1,590,215,715	395,000	1,703,536,819	315,000	1,384,834,239	(*o*) 243,650	1,104,515,942	8
247,700	526,800	2,384,528,500	547,600	2,654,901,300	507,700	2,438,304,900	447,500	2,142,549,100	9
166,200	(*m*) 262,000	1,479,180,000	(*m*) 276,000	1,544,252,000	(*m*) 224,000	1,305,004,000	211,000	1,131,133,000	10
201,800	421,000	1,762,798,306	432,000	1,981,239,709	422,600	1,847,072,621	(*n*) 398,300	1,745,776,428	11
213,000	(*m*) 370,072	1,954,460,032	(*m*) 350,000	1,871,797,392	(*m*) 355,611	1,719,825,708	319,599	1,449,881,883	12
193,300	345,720	1,875,470,490	362,787	1,938,955,818	319,325	1,764,742,160	(*o*) 332,405	1,727,565,353	13
212,500	416,750	1,707,945,749	376,400	1,715,250,122	338,600	1,586,177,553	(*n*) 248,280	1,759,143,119	14
155,500	186,869	1,361,763,671	190,123	1,246,330,283	178,016	1,047,466,830	(*n*,*G*) 154,044	884,762,116	15
169,300	298,500	1,443,264,200	285,800	1,251,104,868	(*m*) 253,000	1,176,653,000	203,002	908,579,200	16
145,700	(*m*) 280,600	1,613,396,000	(*m*) 265,000	1,484,761,000	(*m*) 230,000	1,270,328,000	216,000	1,095,378,000	17
57,800	127,900	527,694,000	129,600	610,962,200	124,500	655,035,700	127,000	634,248,100	18
150,600	301,955	1,364,739,226	257,125	1,146,516,743	223,700	909,962,847	(*n*) 185,000	697,306,888	19
143,100	158,400	729,805,500	.....	.....	.....	.....	.....	.....	20
150,200	(*m*) 323,367	1,370,467,732	(*m*) 315,870	1,447,193,594	(*m*) 331,768	1,282,476,855	293,731	1,138,838,831	21
155,800	304,000	1,510,950,299	.....	1,573,445,327	(*m*) 295,300	1,434,185,024	276,900	1,328,526,578	22
119,700	(*m*) 289,017	1,073,796,288	(*m*) 275,501	1,041,388,668	(*m*) 252,777	857,209,496	224,508	748,502,053	23
132,700	262,000	1,161,459,375	261,000	1,203,652,405	249,000	1,052,549,327	213,000	936,704,222	24
115,200	198,324	1,039,422,000	163,900	(*I*) 430,779,000	.....	.....	.....	.....	25
128,500	(*m*) 276,586	1,243,228,676	(*m*) 284,359	1,311,738,004	(*m*) 262,860	1,148,886,380	229,314	1,026,886,645	26
83,500	188,000	564,056,174	108,000	476,878,300	(*m*) 107,000	430,427,600	101,000	426,426,000	27
121,500	210,000	1,024,205,047	.....	969,071,015	.....	908,760,906	.....	839,375,628	28
116,000	248,000	1,072,090,387	270,772	1,198,947,711	230,000	1,102,278,322	225,919	930,285,847	29
100,900	188,200	933,093,920	186,000	910,934,486	167,900	825,430,643	(*o*) 165,000	786,877,691	30
107,000	216,000	1,293,449,000	229,800	1,611,521,000	.....	1,583,985,000	191,100	1,366,997,834	31
104,100	192,623	980,325,415	(*m*) 193,392	941,992,205	(*m*) 169,219	877,953,546	158,453	787,258,688	32
96,900	.....	980,578,309	.....	.....	.....	.....	.....	.....	33
80,600	158,140	725,194,632	158,320	735,612,022	143,500	645,621,149	140,000	782,173,960	34
86,600	170,000	759,852,996	161,000	722,998,796	152,000	639,415,709	133,300	584,279,702	35
89,500	155,960	850,025,000	172,735	858,353,000	.....	746,709,000	128,120	633,019,740	36
71,900	136,200	647,940,872	132,400	645,165,032	120,300	584,714,544	120,806	488,156,281	37
87,000	150,965	783,433,211	157,600	819,723,857	145,300	730,061,103	137,800	651,397,468	38
59,300	(*m*) 123,000	488,533,981	118,000	449,794,685	108,000	413,992,663	101,000	383,128,587	39
63,000	115,629	568,625,609	123,915	580,426,439	.....	445,804,848	.....	354,047,654	40
36,600	.....	.....	.....	.....	.....	.....	.....	.....	41
69,900	108,361	596,413,000	110,464	511,225,000	.....	390,533,000	.....	250,542,000	42
61,000	108,100	514,453,563	101,800	480,970,175	95,100	440,886,606	(*n*) 88,200	409,680,096	43
68,800	128,000	589,240,400	123,600	603,423,300	128,500	549,922,100	(*o*) 120,900	495,663,700	44
50,800	98,405	440,721,000	102,780	442,818,000	.....	374,563,000	84,200	355,707,000	45
53,100	(*m*) 83,540	476,173,234	(*m*) 94,575	410,083,711	.....	441,845,615	.....	374,724,290	46
74,300	(*m*) 135,405	746,475,000	142,505	882,360,000	(*m*) 132,390	830,862,000	118,678	784,402,000	47
35,300	83,600	493,888,420	83,400	464,339,110	82,400	528,895,495	.....	.....	48
48,600	65,100	178,976,937	53,200	162,129,679	54,800	148,932,217	.....	.....	49
57,800	102,050	533,762,511	108,300	542,629,220	105,000	491,171,956	.....	.....	50
59,900	103,900	566,409,000	96,205	510,247,000	(*m*) 82,600	436,633,000	75,000	362,094,000	51
56,100	(*m*) 120,860	530,316,000	(*m*) 106,190	538,734,000	(*m*) 91,560	454,600,000	90,110	390,808,000	52
49,100	.....	444,904,828	.....	377,746,958	.....	.....	.....	.....	53
55,800	114,500	643,486,718	.....	692,070,936	.....	567,869,411	.....	399,543,412	54
51,600	123,230	468,679,050	123,700	514,989,108	100,020	458,973,651	(*o*) 81,400	382,228,176	55
50,500	93,100	476,000,000	105,100	494,805,982	.....	.....	.....	.....	56
52,000	118,300	553,277,582	114,900	611,482,217	111,800	559,090,541	(*o*) 98,700	495,593,161	57

45	Texas Power & Light Company	45	(o)	101,630	(o)	82,240	482,671,000	55,100	(o)	102,5
46	The California Oregon Power Company	46		83,565		80,800	478,306,895	54,600		84,7
47	Utah Power & Light Company	47		90,710		66,340	476,411,537	54,400		103,7
48	Hetch Hetchy Water Supply (San Francisco)	48		84,600		84,600	469,418,170	53,600		83,6
49	Assoc. Gas & Elec. System (South Carolina Group) (*h*)	49	(o)	131,000	(o)	131,000	463,031,379	52,800	(o)	117,7
50	Illinois Power & Light Corporation (Illinois)	50		97,500		.....	458,656,166	52,400		99,0
51	Houston Lighting & Power Company	51		83,000		80,900	442,468,000	50,500	(o)	82,6
52	Indiana & Michigan Electric Company	52		105,000		61,890	441,374,426	50,380		110,5
53	N. Y. State Elec. & Gas Corp. Group (Assoc. G. & E. System)	53	(o)	101,730	(o)	49,188	437,172,115	49,900	(o)	74,5
54	Oklahoma Gas & Electric Company	54		83,678		80,178	429,121,897	49,000		83,1
55	Toledo Edison Company	55	(o)	87,000	(o)	86,792	412,111,501	47,000	(o)	95,4
56	Western Massachusetts Companies System	56		74,800		.....	412,011,000	47,000		76,7
57	Ohio Public Service Company	57	(o)	95,900	(o)	63,700	408,607,809	46,600	(o)	90,3
58	Montaup Electric Company	58		100,800		77,860	407,000,000	46,500		91,6
59	Central Maine Power Company	59		90,205		85,070	405,825,340	46,300	(o)	85,7
60	Northern Indiana Public Service Company	60		70,450		.....	403,796,004	46,100		72,6
61	Idaho Power Company	61	(o)	71,774	(o)	66,030	402,651,686	45,960	(o)	74,9
62	Louisville Gas & Electric Company (Del.) Subsidiaries	62		.....		.....	394,982,180	45,100		.....
63	Assoc. Gas & Elec. System (West. Penna. Group) (*i*)	63	(o)	72,980	(o)	70,080	358,791,637	40,950	(o)	74,8
64	Los Angeles Gas & Electric Corporation	64		111,700		111,700	356,207,095	40,700		104,7
65	Rochester Gas & Electric Corporation	65	(o)	67,950	(o)	48,704	331,452,354	37,840	(o)	68,3
66	City of Seattle, Light & Power Dept.	66		83,000		73,000	321,750,000	36,730		87,5
67	Texas Electric Service Company	67	(o)	77,600	(o)	77,600	320,440,000	36,600	(o)	83,6
68	Nebraska Power Company	68	(o)	64,500	(o)	64,500	314,902,500	35,950	(o)	63,4
69	Minnesota Power & Light Company	69	(o)	64,513	(o)	64,513	306,676,549	35,000	(o)	70,7
70	Central Illinois Public Service Company	70		72,200		42,000	302,560,900	34,550		86,0
71	The Nevada-California Electric Corporation System (*B*)	71		54,400		51,500	300,679,349	34,320		56,9
72	Indianapolis Power & Light Company	72		.....		.....	297,288,429	33,900		.....
73	New Orleans Public Service Inc.	73		72,000		72,000	296,420,000	33,800		70,0
74	Arkansas Power & Light Company	74	(o)	55,466	(o)	52,000	295,801,000	33,750		63,0
75	The Hartford Electric Light Company	75		75,300		84,400	289,961,078	33,100		70,5
76	Tennessee Valley Authority*	76		121,000		121,300	287,862,300	32,900		128,0
77	Public Service Company of Colorado	77	(o)	64,085	(o)	64,085	285,823,418	32,600	(o)	66,5
78	Kentucky Utilities Company	78		51,000		47,000	268,974,708	30,700		60,8
79	Northwestern Electric Company	79	(o)	63,198	(o)	44,296	266,943,824	30,500	(o)	55,1
80	The United Illuminating Company	80		.....		.....	263,259,000	30,050		.....
81	The Columbus Railway, Power & Light Company	81	(o)	59,300	(o)	59,300	261,858,960	29,900	(o)	55,0
82	Long Island Lighting Company System	82		77,400		77,400	258,341,534	29,500		76,0
83	Wisconsin Public Service Corporation* (*k*)	83	(o)	61,100	(o)	51,300	255,942,597	29,200	(o)	44,6
84	Wisconsin Power & Light Company	84		53,290		43,290	252,759,140	28,850		64,8
85	Central Illinois Light Company*	85	(o)	64,230		.....	248,224,980	28,340	(o)	32,7
86	Central Hudson Gas & Electric Corporation	86		77,900	(*d*)	31,800	245,116,652	27,980		82,2
87	The Scranton Electric Company	87		52,000		52,000	239,666,837	27,350		51,2
88	City of Tacoma, Dept. of Public Utilities	88		50,000		59,000	229,619,600	26,200		51,0
89	Kansas Gas & Electric Company	89		46,000		46,000	225,142,400	25,700		49,0
90	Gulf States Utilities Company	90		42,314		35,400	224,410,809	25,620		44,9
91	Penn Central Light & Power Company	91		.....		49,500	219,733,000	25,080		.....
92	Salt River Valley Water Users' Association	92		49,070		49,070	218,534,735	24,940		43,0
93	Virginia Public Service Company	93		51,200		49,700	217,014,594	24,770		49,4
94	Dallas Power & Light Company	94	(o)	48,300	(o)	48,000	210,132,192	24,000	(o)	49,3
95	Southwestern Gas & Electric Company	95		41,500		32,000	207,266,866	23,650		32,4
96	Jersey Central Power & Light Company	96		52,600		54,000	202,881,893	23,160		52,2
97	Blackstone Valley Gas & Electric Company	97		53,676		.....	200,348,632	22,870	(o)	47,6
98	West Texas Utilities Company	98		41,155		38,300	199,494,332	22,800		47,6
99	Central Power & Light Company	99		37,485		30,000	197,389,553	22,530		33,0
100	Birmingham Electric Company	100	(o)	37,983		.....	196,012,000	22,400		41,1
101	Atlantic City Electric Company	101		46,700		46,700	193,920,216	22,140		49,5
102	Florida Power & Light Company	102		56,700		55,900	191,185,000	21,830		59,1
103	Public Service Company of Oklahoma	103		37,700		34,000	189,363,937	21,600		39,0
104	Public Service Company of New Hampshire	104	(o)	46,760	(o)	44,960	188,638,612	21,500	(o)	47,7
105	City of Detroit, Public Lighting Commission	105		50,000		43,500	183,043,585	20,900		52,0
106	New Bedford Gas & Edison Light Company	106	(o)	48,300	(o)	48,300	179,947,100	20,550	(o)	44,2
107	Empire District Electric Company	107	(o)	38,900	(o)	38,900	179,266,869	20,450	(o)	33,1
108	Des Moines Electric Light Company	108		43,600		43,600	178,667,276	20,400		40,0
109	San Diego Consolidated Gas & Electric Company	109		44,650		50,500	178,032,900	20,320		44,7
110	Pacific Power & Light Company	110		40,695		19,765	173,930,919	19,850		57,7
111	Memphis Power & Light Company	111	(o)	40,000	(o)	40,000	169,072,480	19,300		40,5
112	San Antonio Public Service Company	112	(o)	35,677	(o)	29,877	165,681,499	18,900		42,3
113	Cumberland County Power & Light Company	113		38,300		27,800	159,327,841	18,190		39,1
114	City of Cleveland, Dept. of Public Utilities	114		37,500		37,500	157,233,300	17,950		36,5
115	Sioux City Gas & Electric Co., Iowa Pub. Serv. Co. System	115		36,356		34,515	152,802,616	17,440		34,4
116	The Connecticut Power Company	116		28,380		11,040	143,905,100	16,430		25,7
117	Tampa Electric Company	117		33,000		33,000	143,553,046	16,390		28,2
118	Pennsylvania Power Company	118	(o)	31,000		.....	141,135,632	16,110		34,0
119	The Kansas Power & Light Company	119		.....		34,500	139,099,428	15,880		.....
120	Northern Indiana Power Company (*L*)	120		41,540		1,620	138,628,416	15,820		36,3
121	Luzerne County Gas & Electric Corporation	121		26,800		35,600	134,761,462	15,380		26,7
122	Mississippi Power & Light Company	122		32,464		.....	132,668,159	15,140		30,3
123	Indiana General Service Company	123		28,000		8,700	130,082,544	14,850		28,2
124	Interstate Power Company and Subsidiaries	124		.....		.....	128,431,109	14,660		.....
125	Indiana Service Corporation	125		33,000		16,000	126,644,400	14,460		31,3
126	Iowa Electric Light & Power Company	126		28,825		28,825	126,074,818	14,390		31,2
127	Delaware Power & Light Company	127		25,548		.....	120,052,212	13,700		26,9
128	Staten Island Edison Corporation	128	(o)	29,500	(o)	29,200	114,787,730	13,100	(o)	30,6
129	Moline-Rock Island Manufacturing Company	129		30,960		28,000	114,354,156	13,050		28,8
130	The United Power & Light Corporation (of Kansas)	130		24,440		.....	114,234,330	13,040		24,5
131	Mississippi Power Company	131	(o)	22,134		.....	104,019,804	11,870		25,3
132	Bangor Hydro-Electric Company	132	(o)	26,700	(o)	26,700	102,703,144	11,720	(o)	21,1
133	South Carolina Power Company	133	(o)	29,700		.....	101,504,990	11,590	(o)	26,1
134	Florida Power Corporation and Subsidiaries	134		23,300		23,300	95,226,852	10,870		26,7
135		135		20,000		5,000	93,030,833	10,500		20,0

102,540	(o)	82,630	435,440,000	49,550	(o)	105,225	(o)	89,890	445,325,000	50,800		98,405	440,721,000	102,780	442,818,0
84,700		81,795	471,471,767	53,700		92,425		81,760	465,156,805	53,100	(m)	83,540	476,173,234	(m) 94,575	410,083,7
103,710		67,160	493,678,000	56,200		119,390		100,500	650,549,000	74,300	(m)	135,405	746,475,000	142,505	882,360,0
83,600		83,600	507,323,840	57,700		83,600		83,600	309,450,010	35,300		83,600	493,888,420	83,400	464,339,1
117,700	(o)	117,700	397,764,719	45,250	(o)	123,900	(o)	123,900	425,907,556	48,600		65,100	178,976,937	53,200	162,129,6
99,000			458,872,819	52,260		99,000			506,145,010	57,800		102,050	533,762,511	108,300	542,629,2
82,600	(o)	79,500	435,971,000	49,600	(o)	96,210	(o)	93,100	524,913,000	59,900		103,900	566,409,000	96,205	510,247,0
110,500		87,620	408,462,952	46,600		126,160		95,620	491,439,695	56,100	(m)	120,860	530,316,000	(m) 106,190	538,734,0
74,500	(o)	38,000	412,760,797	47,000	(o)	89,500	(o)	33,500	430,009,374	49,100			444,904,828		377,746,9
83,152			430,351,857	49,000		99,494		95,530	489,174,640	55,800		114,500	643,486,718		692,070,9
95,400	(o)	81,000	389,779,858	44,350	(o)	107,030	(o)	95,000	452,178,712	51,600		123,230	468,679,050	123,700	514,989,1
76,700			433,146,000	49,300		86,100		85,100	443,000,000	50,500		93,100	476,000,000	105,100	494,805,9
90,300	(o)	56,200	395,239,555	45,000	(o)	103,200	(o)	71,000	455,840,667	52,000		118,300	553,277,582	114,900	611,482,2
91,600		77,920	333,403,000	37,960		89,800		77,940	435,364,000	49,700		90,200	374,034,000	101,000	338,215,6
85,750			361,974,791	41,200	(o)	88,070			440,667,827	50,300		69,200	295,981,170	53,045	270,606,6
72,600		70,000	373,324,371	42,500		76,650			423,230,408	48,300		68,740	370,866,979	66,928	334,913,6
74,916	(o)	65,700	391,999,391	44,650	(o)	68,857	(o)	66,440	450,864,575	51,500		70,130	482,065,456	71,114	471,732,0
			410,323,910	45,700					450,407,520	51,400	(m)	91,235	348,598,452		328,598,5
74,820	(o)	73,800	370,582,826	42,150	(o)	84,300	(o)	84,000	411,565,334	46,900					
104,700		104,700	340,886,410	38,800		115,900		115,900	429,006,384	48,970		115,000	388,312,942	90,000	304,100,6
68,378	(o)	60,241	336,846,546	38,350	(o)	72,727	(o)	71,227	366,281,440	41,800		78,008	387,454,655	83,023	393,506,3
87,500		87,500	334,605,000	38,100		90,000		90,000	353,764,500	40,400		89,000	384,812,680	80,000	364,959,9
83,622	(o)	82,152	452,534,000	51,550	(o)	86,190	(o)	82,720	521,669,355	59,500		71,780	568,018,000		665,625,0
63,400	(o)	63,400	313,610,700	35,680	(o)	70,600	(o)	70,600	345,568,500	39,400		65,000	320,411,600	55,000	265,901,5
70,735	(o)	70,735	336,451,669	38,300	(o)	86,870	(o)	86,870	391,586,638	44,700		95,823	456,913,135	87,736	427,848,1
86,000			320,293,529	36,460		83,000			342,162,436	39,100		87,500	366,474,373	86,300	367,912,9
56,900		54,700	295,604,426	33,620		48,900		41,800	275,500,157	31,450		51,400	292,135,954	55,800	300,320,5
			302,836,096	34,500		76,500		61,900	344,025,888	39,300		78,600	374,997,370	82,800	388,871,3
70,000		63,500	297,521,000	33,900		74,000		74,000	341,034,400	38,900		70,100	350,484,000	68,000	345,847,0
63,000		25,000	301,055,000	34,280		62,500		28,300	304,690,000	34,800		66,100	331,538,000		310,955,0
70,500		67,000	281,846,464	32,060	(o)	80,000	(o)	83,000	368,970,842	42,200		59,800	396,238,000	55,900	362,855,3
128,000		136,000	286,638,000	32,650		161,634		162,034	345,603,400	39,400		145,092	306,119,200	112,500	171,681,6
66,562			293,178,934	33,400	(o)	71,783	(o)	71,783	318,427,572	36,350		73,682	331,467,254	72,453	319,607,3
60,800		55,800	251,322,584	28,600		56,000		50,500	249,540,548	28,500		68,570	252,292,869	(m) 60,000	240,724,3
55,150	(o)	37,100	284,388,516	32,400	(o)	54,440	(o)	50,400	287,290,707	32,800		54,160	278,947,541	56,000	286,529,0
			250,832,000	28,590					278,062,000	31,800			283,365,700		288,417,2
55,000	(o)	55,000	261,830,100	29,800	(o)	61,000	(o)	61,000	270,864,584	30,900		71,000	294,445,800	70,000	315,558,3
76,000		76,000	258,926,233	29,500		70,500		70,500	244,156,063	27,850		64,900	222,301,296	48,000	197,097,1
44,600	(o)	44,600	161,601,100	18,410	(o)	44,600			185,877,236	21,200		48,300	205,587,325	(m) 50,400	176,194,1
64,850		61,000	271,008,229	30,860		66,380		61,480	284,597,748	32,500		67,600	292,252,317	60,784	296,527,8
32,791			131,320,248	14,970		35,000		0	151,421,136	17,300		37,500	171,834,023	39,400	177,338,4
82,200	(d)	34,200	324,958,106	37,000		53,500			221,840,852	25,300		50,000	195,689,541	55,400	200,566,8
51,200		51,200	242,866,592	27,650		51,400		51,400	263,811,192	30,100	(m)	55,500	279,155,000	(m) 58,200	240,508,0
51,000		63,000	219,414,450	24,970		55,000		66,000	253,913,000	29,000		53,000	254,074,415	54,300	255,771,5
49,000		49,000	235,850,500	26,860		50,600		50,600	251,304,100	28,700		52,500	271,396,600	62,400	284,354,0
44,958		38,410	223,004,239	25,400		47,810		36,000	266,182,789	30,400		52,000	293,365,397	47,000	273,182,8
		47,800	212,223,069	24,180				47,500	234,162,059	26,700		50,100	243,323,574	50,300	237,817,2
43,075		43,075	191,951,640	21,860				63,160	292,324,270	33,400	(m)	53,370	276,816,917	(m) 46,315	188,665,6
49,400		47,700	219,240,422	24,930		53,115		55,680	220,893,275	25,200		44,400	193,392,263		
49,300	(o)	49,000	209,154,642	23,800	(o)	52,300	(o)	52,000	220,291,750	25,100		53,000	215,889,590	55,400	199,099,2
32,400		28,000	194,055,928	22,080				30,300	196,644,219	22,400			163,474,091		149,696,7
52,200		61,500	198,850,022	22,650		58,000		54,000	192,586,692	22,000		40,000	144,902,031		
47,628	(o)	18,000	179,572,365	20,450	(o)	46,187	(o)	6,000	192,089,421	21,950		49,815	183,442,323	55,515	207,701,1
47,660			186,102,888	21,200		42,915			203,968,162	23,300		41,140	231,817,948	39,000	246,515,3
33,095		30,000	220,637,696	25,140		48,025		43,125	249,425,222	28,500		55,270	276,668,160	(m) 42,800	239,756,6
41,196			198,282,094	22,580		48,363		0	252,222,842	28,800		52,464	277,437,821	54,820	292,759,1
49,500		49,500	192,354,557	21,920		52,900		52,900	213,819,894	24,400	(m)	50,000	201,758,000	(m) 48,000	184,172,0
59,180		57,930	197,622,270	22,500		65,260		64,880	208,124,600	23,750		67,940	207,310,965	59,208	202,110,0
39,030		34,300	186,934,051	21,280		42,500		37,000	200,698,570	22,900		52,800	268,724,289	(m) 47,000	255,220,1
47,705	(o)	46,705	184,063,033	20,980	(o)	43,700	(o)	42,675	181,949,548	20,750		39,700	157,222,444		
52,000		46,500	190,060,990	21,630				45,000	217,010,380	24,750		44,700	206,514,320	44,000	190,900,8
44,200	(o)	44,200	153,982,440	17,530	(o)	51,200	(o)	51,200	190,585,830	21,700		53,000	195,293,900	58,000	219,020,7
33,100	(o)	33,100	155,431,973	17,710	(o)	37,100	(o)	37,100	178,540,162	20,380		49,600	224,158,905	60,600	258,682,0
40,000		40,000	177,656,470	20,230		42,000		42,000	185,041,631	21,100		42,500	183,658,907	42,500	172,539,1
44,700		44,700	182,035,810	20,730		48,300		48,300	198,800,090	22,650		47,000	179,709,699	(m) 45,300	185,639,0
57,705		15,850	199,201,401	22,680		41,250		18,325	230,487,553	26,300		42,775	220,440,374		251,759,0
40,500		40,500	172,532,740	19,650	(o)	44,700	(o)	44,700	189,341,440	21,600		48,000	195,429,828	45,000	182,112,0
42,300		34,900	172,707,153	19,670		41,700		36,500	199,783,901	22,800	(m)	54,500	238,979,012	51,600	238,200,9
39,100		26,800	142,240,346	16,200		39,815		18,815	149,093,897	17,020		43,220	143,380,401	41,940	144,364,2
36,500		36,500	165,392,410	18,850		37,000		37,000	179,870,560	20,500		38,000	189,781,760	(m) 38,300	198,179,3
34,428		25,858	153,647,061	17,500		39,311			171,071,489	19,530		42,500	175,304,555	40,500	162,477,0
25,700		14,300	139,285,039	15,870		43,452		11,140	132,960,016	15,180		24,755	139,618,715		
28,200		28,200	127,731,492	14,540		27,840		24,600	143,522,953	16,380	(m)	35,630	178,992,370	33,000	170,887,3
34,000			132,689,604	15,110		39,000		0	178,076,358	20,300		45,000	232,425,592		
		33,100	147,425,196	16,790		29,650			143,502,741	16,380		28,700	142,385,334	27,800	122,992,0
36,300			130,816,594	14,910		90,750		68,100	448,574,681	51,200		99,070	441,309,468	93,170	424,300,9
26,710		39,000	124,824,746	14,220	(o)	25,130	(o)	41,750	123,216,441	14,080		40,000	129,087,117	26,810	115,530,3
30,372			132,226,989	15,070		32,074			146,433,090	16,700		31,000	138,781,877	25,508	103,748,7
28,200		20,500	126,841,303	14,450		29,640		2,840	147,896,790	16,880	(m)	31,390	146,368,000	(m) 23,620	145,405,0
			137,742,749	15,690		40,403		33,480	141,315,424	16,130			142,532,297		
31,370		19,000	123,467,451	14,070		35,739		21,000	157,710,391	18,000		37,400	178,538,313	(m) 41,000	180,016,9
31,225		31,225	125,997,054	14,350		32,000		32,000	134,821,422	15,390					
26,931			119,849,982	13,660		28,119		0	136,633,985	15,600		27,880	137,457,239	29,700	134,571,7
30,600	(o)	30,600	116,497,340	13,280	(o)	31,700	(o)	31,700	128,454,330	14,660		31,500	142,486,580	31,800	128,665,8
28,820		26,000	116,424,946	13,270		33,590		29,000	130,452,095	14,900		40,000	157,500,686	40,000	164,206,5
24,500			114,104,546	13,000		26,000			127,308,532	14,530		27,150	127,822,014	23,230	103,802,1
25,305		4,620	103,725,735	11,820		26,783			118,526,461	13,530		27,912	115,634,958	30,300	116,745,7
21,970	(o)	21,970	91,388,626	10,400	(o)	23,830	(o)	23,830	106,550,576	12,160					
26,100	(o)	26,100	89,262,093	10,170		31,200			130,897,921	14,940		26,900	121,419,692	29,440	136,213,0
26,700		26,700	98,446,191	11,210		25,800		25,800	109,489,363	12,500	(m)	25,300	103,891,909		

	(o)	101,630	(o)	82,240	482,671,000	55,100	(o)	102,540	(o)	82,630	435,440,000	49,550	(o)	105,225	(o)	89,890	445,325,000
		83,565		80,800	478,306,895	54,600		84,700		81,795	471,471,767	53,700		92,425		81,760	465,156,805
		90,710		66,340	476,411,537	54,400		103,710		67,160	493,678,000	56,200		119,390		100,500	650,549,000
		84,600		84,600	469,418,170	53,600		83,600		83,600	507,323,840	57,700		83,600		83,600	309,450,010
	(o)	131,000	(o)	131,000	463,031,379	52,800	(o)	117,700	(o)	117,700	397,764,719	45,250	(o)	123,900	(o)	123,900	425,907,556
		97,500			458,656,166	52,400		99,000			458,872,819	52,260		99,000			506,145,010
		83,000		80,900	442,468,000	50,500	(o)	82,600	(o)	79,500	435,971,000	49,600	(o)	96,210	(o)	93,100	524,913,000
		105,000		61,890	441,374,426	50,380		110,500		87,620	408,462,952	46,600		126,160		95,620	491,439,695
	(o)	101,730	(o)	49,188	437,172,115	49,900	(o)	74,500	(o)	38,000	412,760,797	47,000	(o)	89,500	(o)	33,500	430,009,374
		83,678		80,178	429,121,897	49,000		83,152			430,351,857	49,000		99,494		95,530	489,174,640
	(o)	87,000	(o)	86,792	412,111,501	47,000	(o)	95,400	(o)	81,000	389,779,858	44,350	(o)	107,030	(o)	95,000	452,178,712
		74,800			412,011,000	47,000		76,700			433,146,000	49,300		86,100		85,100	443,000,000
	(o)	95,900	(o)	63,700	408,607,809	46,600	(o)	90,300	(o)	56,200	395,239,555	45,000	(o)	103,200	(o)	71,000	455,840,667
		100,800		77,860	407,000,000	46,500		91,600		77,920	333,403,000	37,960		89,800		77,940	435,364,000
		90,205		85,070	405,825,340	46,300	(o)	85,750			361,974,791	41,200	(o)	88,070			440,667,827
		70,450			403,796,004	46,100		72,600		70,000	373,324,371	42,500		76,650			423,230,408
	(o)	71,774	(o)	66,030	402,651,686	45,960	(o)	74,916	(o)	65,700	391,999,391	44,650	(o)	68,857	(o)	66,440	450,864,575
					394,982,180	45,100					410,323,910	45,700					450,407,520
	(o)	72,980	(o)	70,080	358,791,637	40,950	(o)	74,820	(o)	73,800	370,582,826	42,150	(o)	84,300	(o)	84,000	411,565,334
		111,700		111,700	356,207,095	40,700		104,700		104,700	340,886,410	38,800		115,900		115,900	429,006,384
	(o)	67,950	(o)	48,704	331,452,354	37,840	(o)	68,378	(o)	60,241	336,846,546	38,350	(o)	72,727	(o)	71,227	366,281,440
		83,000		73,000	321,750,000	36,730		87,500		87,500	334,605,000	38,100		90,000		90,000	353,764,500
	(o)	77,600	(o)	77,600	320,440,000	36,600	(o)	83,622	(o)	82,152	452,534,000	51,550	(o)	86,190	(o)	82,720	521,669,355
	(o)	64,500	(o)	64,500	314,902,500	35,950	(o)	63,400	(o)	63,400	313,610,700	35,680	(o)	70,600	(o)	70,600	345,568,500
	(o)	64,513	(o)	64,513	306,676,549	35,000	(o)	70,735	(o)	70,735	336,451,669	38,300	(o)	86,870	(o)	86,870	391,586,638
		72,200		42,000	302,560,900	34,550		86,000			320,293,529	36,460		83,000			342,162,436
		54,400		51,500	300,679,349	34,320		56,900		54,700	295,604,426	33,620		48,900		41,800	275,500,157
					297,288,429	33,900					302,836,096	34,500		76,500		61,900	344,025,888
		72,000		72,000	296,420,000	33,800		70,000		63,500	297,521,000	33,900		74,000		74,000	341,034,400
	(o)	55,466	(o)	52,000	295,801,000	33,750		63,000		25,000	301,055,000	34,280		62,500		28,300	304,690,000
		75,300		84,400	289,961,078	33,100		70,500		67,000	281,846,464	32,060	(o)	80,000	(o)	83,000	368,970,842
		121,000		121,300	287,862,300	32,900		128,000		136,000	286,638,000	32,650		161,634		162,034	345,603,400
	(o)	64,085	(o)	64,085	285,823,418	32,600	(o)	66,562			293,178,934	33,400	(o)	71,783	(o)	71,783	318,427,572
		51,000		47,000	268,974,708	30,700		60,800		55,800	251,322,584	28,600		56,000		50,500	249,540,548
	(o)	63,198	(o)	44,296	266,943,824	30,500	(o)	55,150	(o)	37,100	284,388,516	32,400	(o)	54,440	(o)	50,400	287,290,707
					263,259,000	30,050					250,832,000	28,590					278,062,000
	(o)	59,300	(o)	59,300	261,858,960	29,900	(o)	55,000	(o)	55,000	261,830,100	29,800	(o)	61,000	(o)	61,000	270,864,584
		77,400		77,400	258,341,534	29,500		76,000		76,000	258,926,233	29,500		70,500		70,500	244,156,063
	(o)	61,100	(o)	51,300	255,942,597	29,200	(o)	44,600	(o)	44,600	161,601,100	18,410	(o)	44,600			185,877,236
		53,290		43,290	252,759,140	28,850		64,850		61,000	271,008,229	30,860		66,380		61,480	284,597,748
	(o)	64,230			248,224,980	28,340	(o)	32,791			131,320,248	14,970		35,000		0	151,421,136
		77,900	(d)	31,800	245,116,652	27,980		82,200	(d)	34,200	324,958,106	37,000		53,500			221,840,852
		52,000		52,000	239,666,837	27,350		51,200		51,200	242,866,592	27,650		51,400		51,400	263,811,192
		50,000		59,000	229,619,600	26,200		51,000		63,000	219,414,450	24,970		55,000		66,000	253,913,000
		46,000		46,000	225,142,400	25,700		49,000		49,000	235,850,500	26,860		50,600		50,600	251,304,100
		42,314		35,400	224,410,809	25,620		44,958		38,410	223,004,239	25,400		47,810		36,000	266,182,789
				49,500	219,733,000	25,080				47,800	212,223,069	24,180				47,500	234,162,059
		49,070		49,070	218,534,735	24,940		43,075		43,075	191,951,640	21,860				63,160	292,324,270
		51,200		49,700	217,014,594	24,770		49,400		47,700	219,240,422	24,930		53,115		55,680	220,893,275
	(o)	48,300	(o)	48,000	210,132,192	24,000	(o)	49,300	(o)	49,000	209,154,642	23,800	(o)	52,300	(o)	52,000	220,291,750
		41,500		32,000	207,266,866	23,650		32,400		28,000	194,055,928	22,080				30,300	196,644,219
		52,600		54,000	202,881,893	23,160		52,200		61,500	198,850,022	22,650		58,000		54,000	192,586,692
		53,676			200,348,632	22,870	(o)	47,628	(o)	18,000	179,572,365	20,450	(o)	46,187	(o)	6,000	192,089,421
		41,155		38,300	199,494,332	22,800		47,660			186,102,888	21,200		42,915			203,968,162
		37,485		30,000	197,389,553	22,530		33,095		30,000	220,637,696	25,140		48,025		43,125	249,425,222
	(o)	37,983			196,012,000	22,400		41,196			198,282,094	22,580		48,363		0	252,222,842
		46,700		46,700	193,920,216	22,140		49,500		49,500	192,354,557	21,920		52,900		52,900	213,819,894
		56,700		55,900	191,185,000	21,830		59,180		57,930	197,622,270	22,500		65,260		64,880	208,124,600
		37,700		34,000	189,363,937	21,600		39,030		34,300	186,934,051	21,280		42,500		37,000	200,698,570
	(o)	46,760	(o)	44,960	188,638,612	21,500	(o)	47,705	(o)	46,705	184,063,033	20,980	(o)	43,700	(o)	42,675	181,949,548
		50,000		43,500	183,043,585	20,900		52,000		46,500	190,060,990	21,630				45,000	217,010,380
	(o)	48,300	(o)	48,300	179,947,100	20,550	(o)	44,200	(o)	44,200	153,982,440	17,530	(o)	51,200	(o)	51,200	190,585,830
	(o)	38,900	(o)	38,900	179,266,869	20,450	(o)	33,100	(o)	33,100	155,431,973	17,710	(o)	37,100	(o)	37,100	178,540,162
		43,600		43,600	178,667,276	20,400		40,000		40,000	177,656,470	20,230		42,000		42,000	185,041,631
		44,650		50,500	178,032,900	20,320		44,700		44,700	182,035,810	20,730		48,300		48,300	198,800,090
		40,695		19,765	173,930,919	19,850		57,705		15,850	199,201,401	22,680		41,250		18,325	230,487,553
	(o)	40,000	(o)	40,000	169,072,480	19,300		40,500		40,500	172,532,740	19,650	(o)	44,700	(o)	44,700	189,341,440
	(o)	35,677	(o)	29,877	165,681,499	18,900		42,300		34,900	172,707,153	19,670		41,700		36,500	199,783,901
		38,300		27,800	159,327,841	18,190		39,100		26,800	142,240,346	16,200		39,815		18,815	149,093,897
		37,500		37,500	157,233,300	17,950		36,500		36,500	165,392,410	18,850		37,000		37,000	179,870,560
		36,356		34,515	152,802,616	17,440		34,428		25,858	153,647,061	17,500		39,311			171,071,489
		28,380		11,040	143,905,100	16,430		25,700		14,300	139,285,039	15,870		43,452		11,140	132,960,016
		33,000		33,000	143,553,046	16,390		28,200		28,200	127,731,492	14,540		27,840		24,600	143,522,953
	(o)	31,000			141,135,632	16,110		34,000			132,689,604	15,110		39,000		0	178,076,358
				34,500	139,099,428	15,880				33,100	147,425,196	16,790		29,650			143,502,741
		41,540		1,620	138,628,416	15,820		36,300			130,816,594	14,910		90,750		68,100	448,574,681
		26,800		35,600	134,761,462	15,380		26,710		39,000	124,824,746	14,220	(o)	25,130	(o)	41,750	123,216,441
		32,464			132,668,159	15,140		30,372			132,226,989	15,070		32,074			146,433,090
		28,000		8,700	130,082,544	14,850		28,200		20,500	126,841,303	14,450		29,640		2,840	147,896,790
					128,431,109	14,660					137,742,749	15,690		40,403		33,480	141,315,424
		33,000		16,000	126,644,400	14,460		31,370		19,000	123,467,451	14,070		35,739		21,000	157,710,391
		28,825		28,825	126,074,818	14,390		31,225		31,225	125,997,054	14,350		32,000		32,000	134,821,422
		25,548			120,052,212	13,700		26,931			119,849,982	13,660		28,119		0	136,633,985
	(o)	29,500	(o)	29,200	114,787,730	13,100	(o)	30,600	(o)	30,600	116,497,340	13,280	(o)	31,700	(o)	31,700	128,454,330
		30,960		28,000	114,354,156	13,050		28,820		26,000	116,424,946	13,270		33,590		29,000	130,452,095
		24,440			114,234,330	13,040		24,500			114,104,546	13,000		26,000			127,308,532
	(o)	22,134			104,019,804	11,870		25,305		4,620	103,725,735	11,820		26,783			118,526,461
	(o)	26,700	(o)	26,700	102,703,144	11,720	(o)	21,970	(o)	21,970	91,388,626	10,400	(o)	23,830	(o)	23,830	106,550,576
	(o)	29,700			101,504,990	11,590	(o)	26,100	(o)	26,100	89,262,093	10,170		31,200			130,897,921
		23,300		23,300	95,226,852	10,870		26,700		26,700	98,446,191	11,210		25,800		25,800	109,489,363

107	Empire District Electric Company	107															
108	Des Moines Electric Light Company	108		43,600	(o)	43,600	178,667,276	20,400		40,000							
109	San Diego Consolidated Gas & Electric Company	109		44,650		50,500	178,032,900	20,320		44,700							
110	Pacific Power & Light Company	110		40,695		19,765	173,930,919	19,850		57,705							

50,800		98,405	440,721,000		102,780	442,818,000	.....		374,563,000		84,200	355,707,000	45
53,100	(m)	83,540	476,173,234	(m)	94,575	410,083,711	.....		441,845,615	.....		374,724,290	46
74,300	(m)	135,405	746,475,000		142,505	882,360,000	(m)	132,390	830,862,000		118,678	784,402,000	47
35,300		83,600	493,888,420		83,400	464,339,110		82,400	528,895,495	.....		.....	48
48,600		65,100	178,976,937		53,200	162,129,679		54,800	148,932,217	.....		.....	49
57,800		102,050	533,762,511		108,300	542,629,220		105,000	491,171,956	.....		.....	50
59,900		103,900	566,409,000		96,205	510,247,000	(m)	82,600	436,633,000		75,000	362,094,000	51
56,100	(m)	120,860	530,316,000	(m)	106,190	538,734,000	(m)	91,560	454,600,000		90,110	390,808,000	52
49,190	.....		444,904,828	.....		377,746,958	.....		.....	.....		.....	53
55,800		114,500	643,486,718	.....		692,070,936	.....		567,869,411	.....		399,543,412	54
51,600		123,230	468,679,050		123,700	514,989,108		100,020	458,973,651	(o)	81,400	382,228,176	55
50,500		93,100	476,000,000		105,100	494,805,982	.....		.....	.....		.....	56
52,000		118,300	553,277,582		114,900	611,482,217		111,800	559,090,541	(o)	98,700	495,593,161	57
49,700		90,200	374,034,000		101,000	338,215,600	.....		.....	.....		.....	58
50,300		69,200	295,981,170		53,045	270,606,693		53,200	240,169,182	(o)	48,600	220,727,440	59
48,300		68,740	370,866,979		66,928	334,913,629		52,094	302,031,809	(n)	44,990	271,440,543	60
51,500		70,130	482,065,456		71,114	471,732,000	(m)	72,080	506,009,000		70,245	352,253,000	61
51,400	(m)	91,235	348,598,452	.....		328,598,520	.....		285,767,900	.....		234,238,160	62
46,900	.....		.....	.....		.....	.....		.....	.....		.....	63
48,970		115,000	388,312,942		90,000	304,100,629		81,500	269,681,600		74,000	247,191,413	64
41,800		78,008	387,454,655		83,023	393,506,327		75,290	376,764,523		80,150	352,809,582	65
40,400		89,000	384,812,680		80,000	364,959,930		75,000	307,909,700		75,000	277,591,025	66
59,500		71,780	568,018,000	.....		665,625,000	(m)	67,494	381,404,000	.....		241,723,000	67
39,400		65,000	320,411,600		55,000	265,901,500	(m)	47,000	219,813,000		41,900	201,094,000	68
44,700		95,823	456,913,135		87,736	427,848,189	(m)	80,696	416,134,000		77,950	401,856,000	69
39,100		87,500	366,474,373		86,300	367,912,947		66,300	339,189,800	(n)	72,600	301,548,168	70
31,450		51,400	292,135,954		55,800	300,320,585		51,900	294,781,380		57,600	279,334,470	71
39,300		78,600	374,997,370		82,800	388,871,320		76,600	356,228,046	(n)	63,500	328,712,384	72
38,900		70,100	350,484,000		68,000	345,847,000	(m)	68,000	338,629,000		66,500	319,842,000	73
34,800		66,100	331,538,000	.....		310,955,000	.....		259,164,000	.....		183,843,000	74
42,200		59,800	396,238,000		55,900	362,855,320		52,500	242,563,000	(n,G)	51,300	220,324,000	75
39,400		145,092	306,119,200		112,500	171,681,600		120,600	222,096,800		125,540	565,609,500	76
36,350		73,682	331,467,254		72,453	319,607,394	(m)	67,797	298,387,145	(o)	63,980	285,892,553	77
28,500		68,570	252,292,869	(m)	60,000	240,724,354		39,910	194,822,819		45,800	185,904,592	78
32,800		54,160	278,947,541		56,000	286,529,056	(m)	53,100	286,820,000		48,100	255,766,000	79
31,800	.....		283,365,700	.....		288,417,200	.....		275,965,650	.....		222,132,700	80
30,900		71,000	294,445,800		70,000	315,558,310		60,000	283,654,155	(n)	55,100	254,843,000	81
27,850		64,900	222,301,296		48,000	197,097,106		50,000	172,923,000		49,000	135,372,000	82
21,200		48,300	205,587,325	(m)	50,400	176,194,115	.....		149,811,913	.....		153,364,676	83
32,500		67,600	292,252,317		60,784	296,527,833	.....		283,520,629	.....		275,376,599	84
17,300		37,500	171,834,023		39,400	177,338,443	.....		156,467,174		31,727	135,692,265	85
25,300		50,000	195,689,541		55,400	200,566,867		53,000	213,612,676	(o)	52,900	222,368,156	86
30,100	(m)	55,500	279,155,000	(m)	58,200	240,508,000	(m)	52,400	245,526,000		51,000	237,512,000	87
29,000		53,000	254,074,415		54,300	255,771,531		49,000	208,399,465		61,500	197,580,149	88
28,700		52,500	271,396,600		62,400	284,354,000	(m)	49,900	249,717,000		44,600	221,118,000	89
30,400		52,000	293,365,397		47,000	273,182,834		35,204	191,081,273		29,754	155,783,691	90
26,700		50,100	243,323,574		50,300	237,817,248		45,800	213,808,418	(n)	45,000	226,892,235	91
33,400	(m)	53,370	276,816,917	(m)	46,315	188,665,617	(m)	55,200	275,550,594		53,275	206,356,017	92
25,200		44,400	193,392,263	.....		.....	.....		.....	.....		.....	93
25,100		53,000	215,889,590		55,400	199,099,200	(m)	46,400	179,165,000		44,300	171,925,970	94
22,400	.....		163,474,091	.....		149,696,794		31,790	119,647,273	.....		.....	95
22,000		40,000	144,902,031	.....		.....	.....		.....	.....		.....	96
21,950		49,815	183,442,323		55,515	207,701,144		54,970	182,918,142	(o)	52,200	165,318,271	97
23,300		41,140	231,817,948		39,000	246,515,315		44,220	147,963,154	.....		.....	98
28,500		55,270	276,668,160	(m)	42,800	239,756,655		34,845	146,744,975	(n)	25,205	120,521,353	99
28,800		52,464	277,437,821		54,820	292,759,162	(m)	53,720	298,379,513		53,811	289,073,000	100
24,400	(m)	50,000	201,758,000	(m)	48,000	184,172,000	(m)	41,500	148,331,000		36,000	157,892,000	101
23,750		67,940	207,310,965		59,208	202,110,030	(m)	60,708	199,322,000		65,364	214,167,000	102
22,900		52,800	268,724,289	(m)	47,000	255,220,126		46,000	224,426,315		39,222	135,199,859	103
20,750		39,700	157,222,444	.....		.....	.....		.....	.....		.....	104
24,750		44,700	206,514,320		44,000	190,900,800	.....		.....	.....		.....	105
21,700		53,000	195,293,900		58,000	219,020,744		56,000	167,613,529		50,500	173,617,378	106
20,380		49,600	224,158,905		60,600	258,682,003	(m)	55,500	226,034,240	(o)	61,000	262,409,515	107
21,100		42,500	183,658,907		42,500	172,539,101		36,000	159,666,072		40,000	134,416,934	108
22,650		47,000	179,709,699	(m)	45,300	185,639,011	.....		153,825,600	.....		126,801,100	109
26,300		42,775	220,440,374	.....		251,759,000	.....		232,877,000		35,105	171,611,000	110
21,600		48,000	195,429,828		45,000	182,112,000	(m)	41,261	172,781,000		46,000	166,244,000	111
22,800	(m)	54,500	238,979,012		51,600	238,200,935	.....		.....	.....		.....	112
17,020		43,220	143,380,401		41,940	144,364,260		30,200	114,835,060	(n)	30,580	116,194,720	113
20,500		38,000	189,781,760	(m)	38,300	198,179,340	(m)	37,200	186,242,950		33,700	174,146,677	114
19,530		42,500	175,304,555		40,500	162,477,080	.....		.....	.....		.....	115
15,180		24,755	139,618,715	.....		.....	.....		.....	.....		.....	116
16,380	(m)	35,630	178,992,370		33,000	170,887,397	(m)	31,720	152,885,453		25,340	114,195,401	117
20,300		45,000	232,425,592	.....		.....	.....		.....	.....		.....	118
16,380		28,700	142,385,334		27,800	122,992,015		30,750	108,519,670	.....		.....	119
51,200		99,070	441,309,468		93,170	424,300,963		84,205	383,337,429		74,100	305,326,889	120
14,080		40,000	129,087,117		26,810	115,530,335	.....		.....	.....		.....	121
16,700		31,000	138,781,877		25,508	103,748,759	.....		.....	.....		.....	122
16,880	(m)	31,390	146,368,000	(m)	23,620	145,405,000	(m)	26,480	122,579,000		24,600	105,634,000	123
16,130	.....		142,532,297	.....		.....	.....		.....	.....		.....	124
18,000		37,400	178,538,313	(m)	41,000	180,016,985		40,000	152,957,600		34,000	131,861,909	125
15,390	.....		.....	.....		.....	.....		.....	.....		.....	126
15,600		27,880	137,457,239		29,700	134,571,700		23,500	122,337,055	(o)	25,000	109,786,578	127
14,660		31,500	142,486,580		31,800	128,665,860		28,100	117,999,180		29,000	107,715,140	128
14,900		40,000	157,500,686		40,000	164,206,522		34,750	151,902,906		31,570	131,017,494	129
14,530		27,150	127,822,014		23,230	103,802,181	.....		.....	.....		.....	130
13,530		27,912	115,634,958		30,300	116,745,731		23,400	93,469,303	(n)	19,000	75,389,189	131
12,160	.....		.....	.....		.....	.....		.....	.....		.....	132
14,940		26,900	121,419,692		29,440	136,213,088	.....		.....	.....		.....	133
12,500	(m)	25,300	103,891,909	.....		.....	.....		.....	.....		.....	134
[illegible]													135
,000		40,000	177,656,470		20,230	42,000		42,000	185,041,631		21,100	42,500	183,858,907		42,500	182,599,101
,700		44,700	182,035,810		20,730	48,300		48,300	198,800,090		22,650	47,000	179,709,699	(m)	45,300	185,639,011
705		15,850	199,201,401		22,680	41,250		18,325	230,487,553		26,300	42,775	220,440,374	.....		251,759,000

(o)	22,134		104,019,804	11,870		25,305	4,620	103,725,735		11,820		26,783		118,526,461
(o)	26,700	(o) 26,700	102,703,144	11,720	(o)	21,970	(o) 21,970	91,388,626		10,400	(o)	23,830	(o) 23,830	106,550,576
(o)	29,700		101,504,990	11,590	(o)	26,100	(o) 26,100	89,262,093		10,170		31,200		130,897,921
	23,300	23,300	95,226,852	10,870		26,700	26,700	98,446,191		11,210		25,800	25,800	109,489,363
	107	Empire District Electric Company						107	(o)	36,900	(o)	36,900		
	108	Des Moines Electric Light Company						108		43,600		43,600	178,667,276	20,400		40,000
	109	San Diego Consolidated Gas & Electric Company						109		44,650		50,500	178,032,900	20,320		44,700
	110	Pacific Power & Light Company						110		40,695		19,765	173,930,919	19,850		57,700
	111	Memphis Power & Light Company						111	(o)	40,000	(o)	40,000	169,072,480	19,300		40,500
	112	San Antonio Public Service Company						112	(o)	35,677	(o)	29,877	165,681,499	18,900		42,300
	113	Cumberland County Power & Light Company						113		38,300		27,800	159,327,841	18,190		39,100
	114	City of Cleveland, Dept. of Public Utilities						114		37,500		37,500	157,233,300	17,950		36,500
	115	Sioux City Gas & Electric Co., Iowa Pub. Serv. Co. System						115		36,356		34,515	152,802,616	17,440		34,420
	116	The Connecticut Power Company						116		28,380		11,040	143,905,100	16,430		25,700
	117	Tampa Electric Company						117		33,000		33,000	143,553,046	16,390		28,200
	118	Pennsylvania Power Company						118	(o)	31,000			141,135,632	16,110		34,000
	119	The Kansas Power & Light Company						119				34,500	139,099,428	15,880		
	120	Northern Indiana Power Company (*L*)						120		41,540		1,620	138,628,416	15,820		36,300
	121	Luzerne County Gas & Electric Corporation						121		26,800		35,600	134,761,462	15,380		26,710
	122	Mississippi Power & Light Company						122		32,464			132,668,159	15,140		30,370
	123	Indiana General Service Company						123		28,000		8,700	130,082,544	14,850		28,200
	124	Interstate Power Company and Subsidiaries						124					128,431,109	14,660		
	125	Indiana Service Corporation						125		33,000		16,000	126,644,400	14,460		31,370
	126	Iowa Electric Light & Power Company						126		28,825		28,825	126,074,818	14,390		31,220
	127	Delaware Power & Light Company						127		25,548			120,052,212	13,700		26,930
	128	Staten Island Edison Corporation						128	(o)	29,500	(o)	29,200	114,787,730	13,100	(o)	30,600
	129	Moline-Rock Island Manufacturing Company						129		30,960		28,000	114,354,156	13,050		28,820
	130	The United Power & Light Corporation (of Kansas)						130		24,440			114,234,330	13,040		24,500
	131	Mississippi Power Company						131	(o)	22,134			104,019,804	11,870		25,305
	132	Bangor Hydro-Electric Company						132	(o)	26,700	(o)	26,700	102,703,144	11,720	(o)	21,970
	133	South Carolina Power Company						133	(o)	29,700			101,504,990	11,590	(o)	26,100
	134	Florida Power Corporation and Subsidiaries						134		23,300		23,300	95,226,852	10,870		26,700
	135	Wheeling Electric Company						135		20,000		5,000	92,039,873	10,500		21,580
	136	Tennessee Public Service Company						136		18,681		100	90,238,272	10,300		20,030
	137	El Paso Electric Company						137		19,000		19,000	85,026,898	9,710		19,900
		Total for United States (*C*)											89,322,845,651			
		Canada														
	138	Hydro-Electric Power Commission of Ontario						1		1,082,000		690,000	4,990,727,444	570,000		828,280
	139	The Shawinigan Water & Power Company (*A*)						2		648,300		474,500	3,842,872,196	438,700		618,100
	140	Canadian Hydro-Electric Corporation, Ltd. System						3		490,289		489,589	2,689,161,650	307,000		503,700
	141	Duke-Price Power Company, Ltd.						4		318,000		318,000	1,724,566,120	196,900		335,000
	142	Montreal Light, Heat & Power Consolidated						5	(*K*)	335,600		126,000	1,529,382,839	174,600		274,000
	143	West Kootenay Power & Light Company, Ltd.						6		99,800		99,800	660,905,059	75,450		82,400
	144	City of Winnipeg Hydro-Electric System						7		98,900		93,331	508,256,900	58,000		94,600
	145	Winnipeg Electric Company (*J*)						8		97,500		97,500	487,213,500	55,600		126,850
	146	Canada Northern Power Corporation, Ltd.						9		65,350		65,350	474,553,410	54,200		60,780
	147	Alcoa Power Company, Ltd.						10		122,000		122,000	455,089,497	51,950		
	148	Canadian Niagara Power Company, Ltd.						11				74,600	428,956,100	49,000		
	149	Beauharnois Light, Heat & Power Company						12		130,000		130,000	421,100,000	48,000		
	150	British Columbia Electric Railway Company, Ltd. (*D*)						13		99,200	(o)	98,100	389,102,000	44,400		100,600
	151	Abitibi Electric Development Company, Ltd.						14		44,000		44,000	227,324,308	25,900		44,700
	152	The Nova Scotia Power Commission						15					199,952,617	22,800		
	153	Southern Canada Power Company, Ltd.						16		42,800		44,400	185,252,237	21,150		41,000
	154	Great Lakes Power Company, Ltd.						17		30,702		30,702	173,949,572	19,850		20,500
	155	Ottawa Valley Power Company						18		70,000		70,000	141,535,800	16,150		
	156	Montreal Island Power Company						19		45,300		45,300	135,786,020	15,500		40,950
	157	Calgary Power Company, Ltd.						20		40,000		36,000	134,886,292	15,400		41,000
		Total for Canada											19,800,573,561			
		Mexico														
	158	The Mexican Light & Power Company, Ltd. and Subsidiaries							(o)	129,626	(o)	129,626	725,351,101	82,800	(o)	124,030
		Electric Railways and Electrified Railroads														
	159	Interborough Rapid Transit Company						1		291,060		291,060	1,147,920,881	131,000		300,760
	160	Williamsburgh Power Plant Corporation (B.M.T.)						2	(o)	161,500	(o)	161,500	608,619,727	69,470	(o)	162,960
	161	Chicago Surface Lines						3					594,098,027	67,800		
	162	Philadelphia Rapid Transit Company						4		90,324			287,666,276	32,800		95,550
	163	The Pennsylvania Railroad (Long Island City Gen. Station)						5					284,602,140	32,500	(o)	99,000
	164	Boston Elevated Railway						6				79,695	220,340,490	25,150		93,030
	165	The New York Central Railroad Company						7				66,000	212,161,952	24,200		84,000
	166	The New York, New Haven & Hartford Railroad Company						8	(o)	41,200	(o)	26,400	154,300,000	17,620		43,000
	167	St. Louis Public Service Company						9		39,880		7,560	141,511,652	16,150		46,180
	168	Pacific Electric Railway Company						10		40,000			133,094,054	15,200		47,000
	169	Twin City Rapid Transit Company						11	(o)	39,620	(o)	38,770	115,356,150	13,170	(o)	42,630
	170	Norfolk & Western Railway Company						12		32,650		21,500	103,837,503	11,850		29,500
	171	The Connecticut Company						13				10,000	75,368,837	8,600		
	172	Chicago, Milwaukee, St. Paul & Pacific Railroad Company						14					70,525,944	8,050		
		Total for Railways and Railroads											4,149,403,633			

*Company names included in last year's table but omitted from this one follow, with the names under which their operations are now included in *italics*:

Illinois Electric Power Co.
Central Illinois Light Co.

Mountain States Power Co.
Not reported (*under* 100,000,000 *kw.-hr.*)

New York Edison System
Consolidated Gas Co. of N. Y. System Elec. Affiliates

Ohio Electric Power Co. Group
Comprised several separate companies not now regarded as a single system

U. S. Government (Muscle Shoals)
Tennessee Valley Authority

Westchester Lighting Co.
Consolidated Gas Co. of N. Y. System Elec. Affiliates

Western United Gas & Electric Co.
Not reported (*under* 100,000,000 kw.-hr.)

Wisconsin Valley Electric Co.
Wisconsin Public Service Corp.

Yonkers Electric Light & Power Co.
Consolidated Gas Co. of N. Y. System Elec. Affiliates

(*a*) Company practice varies as to the period for which the peak is determined. For 1933, 1932 and 1931 peak data were requested on a 30-minute basis. For shorter period the returns have been entere comment. Those for a longer period are note tinction has been made between estimated an values. In earlier years both instantaneous a ute peaks were called for. Detailed infor those years will be found in corresponding is Supplement.

(*b*) Less energy supplied to other electric companie

(*c*) Metropolitan Edison Co. and New Jersey Light Co.

(*d*) Excluding purchases for surplus sales to oth corporations but including purchases to suppl

43,600	43,600	178,667,276	20,400	40,000	40,000	177,656,470	20,230	42,000	42,000	185,041,631		
44,650	50,500	178,032,900	20,320	44,700	44,700	182,035,810	20,730	48,300	48,300	198,800,090		

76	12,160												132		
21	14,940		26,900	121,419,692		29,440	136,213,088						133		
63	12,500	(m)	25,300	103,891,909									134		
													135		
40,000	40,000		177,656,470	20,230		42,000	42,000	185,041,631	21,100		42,500	185,658,907		42,500	172,999,101
44,700	44,700		182,035,810	20,730		48,300	48,300	198,800,090	22,650		47,000	179,709,699	(m)	45,300	185,639,011
57,705	15,850		199,201,401	22,680		41,250	18,325	230,487,553	26,300		42,775	220,440,374			251,759,000
40,500	40,500		172,532,740	19,650	(o)	44,700	(o) 44,700	189,341,440	21,600		48,000	195,429,828		45,000	182,112,000
42,300	34,900		172,707,153	19,670		41,700	36,500	199,783,901	22,800	(m)	54,500	238,979,012		51,600	238,200,935
39,100	26,800		142,240,346	16,200		39,815	18,815	149,093,897	17,020		43,220	143,380,401		41,940	144,364,260
36,500	36,500		165,392,410	18,850		37,000	37,000	179,870,560	20,500		38,000	189,781,760	(m)	38,300	198,179,340
34,428	25,858		153,647,061	17,500		39,311		171,071,489	19,530		42,500	175,304,555		40,500	162,477,080
25,700	14,300		139,285,039	15,870		43,452	11,140	132,960,016	15,180		24,755	139,618,715			
28,200	28,200		127,731,492	14,540		27,840	24,600	143,522,953	16,380	(m)	35,630	178,992,370		33,000	170,887,397
34,000			132,689,604	15,110		39,000	0	178,076,358	20,300		45,000	232,425,592			
	33,100		147,425,196	16,790		29,650		143,502,741	16,380		28,700	142,385,334		27,800	122,992,015
36,300			130,816,594	14,910		90,750	68,100	448,574,681	51,200		99,070	441,309,468		93,170	424,300,963
26,710	39,000		124,824,746	14,220	(o)	25,130	(o) 41,750	123,216,441	14,080		40,000	129,087,117		26,810	115,530,335
30,372			132,226,989	15,070		32,074		146,433,090	16,700		31,000	138,781,877		25,508	103,748,759
28,200	20,500		126,841,303	14,450		29,640	2,840	147,896,790	16,880	(m)	31,390	146,368,000	(m)	23,620	145,405,000
			137,742,749	15,690		40,403	33,480	141,315,424	16,130			142,532,297			
31,370	19,000		123,467,451	14,070		35,739	21,000	157,710,391	18,000		37,400	178,538,313	(m)	41,000	180,016,985
31,225	31,225		125,997,054	14,350		32,000	32,000	134,821,422	15,390						
26,931			119,849,982	13,660		28,119	0	136,633,985	15,600		27,880	137,457,239		29,700	134,571,700
30,600	(o) 30,600		116,497,340	13,280	(o)	31,700	(o) 31,700	128,454,330	14,660		31,500	142,486,580		31,800	128,665,860
28,820	26,000		116,424,946	13,270		33,590	29,000	130,452,095	14,900		40,000	157,500,686		40,000	164,206,522
24,500			114,104,546	13,000		26,000		127,308,532	14,530		27,150	127,822,014		23,230	103,802,181
25,305	4,620		103,725,735	11,820		26,783		118,526,461	13,530		27,912	115,634,958		30,300	116,745,731
21,970	(o) 21,970		91,388,626	10,400	(o)	23,830	(o) 23,830	106,550,576	12,160						
26,100	(o) 26,100		89,262,093	10,170		31,200		130,897,921	14,940		26,900	121,419,692		29,440	136,213,088
26,700	26,700		98,446,191	11,210		25,800	25,800	109,489,363	12,500	(m)	25,300	103,891,909			
21,584			86,783,762	9,880		26,980	0	100,652,334	11,500			113,823,000			119,716,000
20,030	101		93,796,831	10,680		22,387	77	112,918,808	12,900		23,144	114,480,898		23,065	111,870,280
19,900	19,900		89,443,680	10,180		24,034	24,034	110,485,989	12,600		24,000	112,612,701			
28,280	527,420		4,221,001,199	481,000		915,945	699,630	4,387,316,157	500,800		937,320	5,077,430,835		847,710	5,071,853,732
18,100	474,500		3,170,358,660	361,000		540,500		3,436,436,460	392,300	(m)	545,600	3,226,014,549	(m)	538,300	3,726,436,341
03,705	503,005		2,527,827,765	288,000		485,775	485,075	2,414,375,792	275,600		450,000	2,525,560,158		387,000	2,090,788,460
35,000	335,000		1,673,119,325	190,400		307,000	307,000	1,518,632,376	173,400		341,000	2,012,869,376		351,000	2,093,829,000
74,000	127,000		1,249,312,710	142,200		285,150	142,700	1,557,929,949	177,800		310,000	1,650,636,536	(m)	292,020	1,568,864,226
82,400	82,400		580,021,067	66,000		83,500	83,500	591,772,849	67,500		83,700	599,257,403		74,800	539,626,682
94,600	89,287		486,799,830	55,300		89,100	85,845	412,080,147	47,000	(m)	89,223	414,195,787	(m)	73,400	445,579,835
26,850	126,850		518,856,200	59,150		132,700	132,700	614,665,600	70,200		119,750	598,508,500		124,200	703,982,200
60,780	60,780		441,150,290	50,200		57,270	57,270	418,226,810	47,700		50,000	367,130,780		46,000	347,797,680
	(o) 71,400		282,433,000	32,150			74,500	490,148,000	55,950			614,411,500			632,261,900
00,600	98,000		405,750,100	46,200	(o)	100,800	(o) 100,800	425,510,139	48,500		100,200	437,731,126		94,000	418,075,325
44,700	44,700		204,282,001	23,250											
			159,428,487	18,140				173,924,966	19,850			151,414,019			
41,000	41,000		168,544,700	19,200		41,000	41,000	159,873,880	18,250	(m)	40,800	170,619,052		31,000	149,105,925
20,500	20,500		153,646,054	17,500											
40,950	40,950		172,307,040	19,600		44,250	44,250	146,048,890	16,670		41,000	105,805,180			
41,000	33,000		145,950,224	16,630		45,300	35,600	188,668,281	21,500		44,860	139,302,262	(m)	29,500	126,876,335
24,035	(o) 124,035		691,485,448	78,650	(o)	122,907	(o) 122,907	691,150,190	78,900		121,485	681,822,792		111,140	641,828,120
00,700	300,700		1,168,305,375	133,000		301,830	301,830	1,198,884,267	136,900		303,400	1,228,301,211		304,460	1,217,047,460
62,900	(o) 162,900		608,371,076	69,300	(o)	162,600	(o) 162,600	642,157,665	73,300		170,000	618,219,724		159,000	599,442,970
			354,922,052	40,400				595,733,093	68,000		197,574	624,776,062		200,698	(p) 664,908,350
95,507			304,313,972	34,700		102,227	0	333,822,958	38,100		111,750	366,341,403		116,162	384,076,140
99,060	(o) 78,300		291,426,822	33,200	(o)	105,430	95,600	330,309,340	37,700		86,800	343,354,637		89,800	343,646,820
93,030	93,030		244,678,940	27,900		98,490	98,490	257,065,945	29,350		103,194	(F) 270,054,975		91,403	247,473,090
84,000	71,500		228,941,683	26,100		86,300	73,000	250,573,893	28,600		71,600	251,780,404		75,400	247,599,225
43,000	26,600		179,000,000	20,400	(o)	42,800	(o) 28,900	213,400,000	24,300		43,000	225,941,425		41,600	209,370,020
46,182	13,327		152,489,148	17,350		51,287	16,121	159,433,615	18,200		57,395	170,343,455			
47,000			143,901,864	16,400		48,000	0	157,888,334	18,000		48,000	169,134,719		48,000	182,813,760
42,620	(o) 39,560		124,932,815	14,260	(o)	39,798	(o) 38,580	126,174,466	14,400		48,000	133,337,207		49,732	140,190,410
29,500	21,540		99,938,196	11,400		34,300	27,300	116,745,039	13,300		24,000	132,339,094		30,000	134,368,260
	9,600		78,774,178	8,970			10,100	89,641,092	10,220		25,050	106,660,046		16,500	120,427,030
			67,439,697	7,670				91,042,859	10,390			124,593,517			156,186,340

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put of generating stations for use of customers in Central Hudson territory.

(e) Over one-hour period. Excludes "Firm Peak Service" to Potomac Electric Power Co.

(f) Prior to 1932 Pennsylvania Water & Power Co. only.

(g) Includes 7,060,600 kw.-hr. "Firm Peak Service" to Potomac Electric Power Co.

(h) Includes Broad River Power Co. and Lexington Water Power Co. Prior to 1931 Broad River Power Co. only.

(i) Pennsylvania Electric Co., Erie Lighting Co., Clarion River Power Co. and Youghiogheny Hydro-Electric Corp.

(j) Includes effect of supply to neighboring system.

(k) Includes entire year's operations of Wisconsin Valley Electric Co. and subsidiaries acquired June 5, 1933.

(m) Instantaneous.

(n) Over 30-minute period.

(o) Over one-hour period. Actual or estimated.

(p) A.-c. input.

(r) Output measured on d.c. side.

(A) Energy produced from "Water Sold" was included in output prior to 1932. See Supplement, May 6, 1933.

(B) Includes the Southern Sierras Power Co., Nevada-California Power Co. and Yuma Utilities Co.

(C) Canadian Niagara Power Co., L
cluded in Niagara Hudson Powe
also the St. Lawrence Power Co.,

(D) Mainland system only.

(E) Includes Kentucky & West Virgin
Kingsport Utilities, Inc., in 1933,

(F) A.-c. output. Prior to 1930 the
generated as d.c. or after conversi

(G) On generating plant only.

(H) Electric companies affiliated with
Company of New York System
York Edison Co., United Electri

21,100	42,500	185,658,907		42,500	172,999,101										
22,650	47,000	179,709,699	(m)	45,300	185,639,011			153,825,600			126,801,100	109			
26,300	42,775	220,440,374			251,759,000			232,877,000		35,105	171,611,000	110			

Comprised several separate companies not now regarded as a single system

(a) Company practice varies as to the period for which the peak is determined. For 1933, 1932 and 1931 peak data

	43,600		43,600	178,667,276	20,400		40,000	40,000	177,656,470	20,230	
	44,650		50,500	178,032,900	20,320		44,700	44,700	182,035,810	20,730	
	40,695		19,765	173,930,919	19,850		57,705	15,850	199,201,401	22,680	
(o)	40,000	(o)	40,000	169,072,480	19,300		40,500	40,500	172,532,740	19,650	
(o)	35,677	(o)	29,877	165,681,499	18,900		42,300	34,900	172,707,153	19,670	
	38,300		27,800	159,327,841	18,190		39,100	26,800	142,240,346	16,200	
	37,500		37,500	157,233,300	17,950		36,500	36,500	165,392,410	18,850	
	36,356		34,515	152,802,616	17,440		34,428	25,858	153,647,061	17,500	
	28,380		11,040	143,905,100	16,430		25,700	14,300	139,285,039	15,870	
	33,000		33,000	143,553,046	16,390		28,200	28,200	127,731,492	14,540	
(o)	31,000		.....	141,135,632	16,110		34,000	.....	132,689,604	15,110	
	.....		34,500	139,099,428	15,880		.....	33,100	147,425,196	16,790	
	41,540		1,620	138,628,416	15,820		36,300	.....	130,816,594	14,910	
	26,800		35,600	134,761,462	15,380		26,710	39,000	124,824,746	14,220	
	32,464		.....	132,668,159	15,140		30,372	.....	132,226,989	15,070	
	28,000		8,700	130,082,544	14,850		28,200	20,500	126,841,303	14,450	
	.....		.....	128,431,109	14,660		.....	.....	137,742,749	15,690	
	33,000		16,000	126,644,400	14,460		31,370	19,000	123,467,451	14,070	
	28,825		28,825	126,074,818	14,390		31,225	31,225	125,997,054	14,350	
	25,548		.....	120,052,212	13,700		26,931	.....	119,849,982	13,660	
(o)	29,500	(o)	29,200	114,787,730	13,100	(o)	30,600	(o) 30,600	116,497,340	13,280	
	30,960		28,000	114,354,156	13,050		28,820	26,000	116,424,946	13,270	
	24,440		.....	114,234,330	13,040		24,500	.....	114,104,546	13,000	
(o)	22,134		.....	104,019,804	11,870		25,305	4,620	103,725,735	11,820	
(o)	26,700	(o)	26,700	102,703,144	11,720	(o)	21,970	(o) 21,970	91,388,626	10,400	
(o)	29,700		.....	101,504,990	11,590	(o)	26,100	(o) 26,100	89,262,093	10,170	
	23,300		23,300	95,226,852	10,870		26,700	26,700	98,446,191	11,210	
	20,000		5,000	92,039,873	10,500		21,584	.....	86,783,762	9,880	
	18,681		100	90,238,272	10,300		20,030	101	93,796,831	10,680	
	19,000		19,000	85,026,898	9,710		19,900	19,900	89,443,680	10,180	
	.....		.....	89,322,845,651	.....		.....	.....	.....	.....	
	1,082,000		690,000	4,990,727,444	570,000		828,280	527,420	4,221,001,199	481,000	
	648,300		474,500	3,842,872,196	438,700		618,100	474,500	3,170,358,660	361,000	
	490,289		489,589	2,689,161,650	307,000		503,705	503,005	2,527,827,765	288,000	
	318,000		318,000	1,724,566,120	196,900		335,000	335,000	1,673,119,325	190,400	
(K)	335,600		126,000	1,529,382,839	174,600		274,000	127,000	1,249,312,710	142,200	
	99,800		99,800	660,905,059	75,450		82,400	82,400	580,021,067	66,000	
	98,900		93,331	508,256,900	58,000		94,600	89,287	486,799,830	55,300	
	97,500		97,500	487,213,500	55,600		126,850	126,850	518,856,200	59,150	
	65,350		65,350	474,553,410	54,200		60,780	60,780	441,150,290	50,200	
	122,000		122,000	455,089,497	51,950		.....	.....	.....	.....	
	.....		74,600	428,956,100	49,000		.....	(o) 71,400	282,433,000	32,150	
	130,000		130,000	421,100,000	48,000		.....	.....	.....	.....	
	99,200	(o)	98,100	389,102,000	44,400		100,600	98,000	405,750,100	46,200	
	44,000		44,000	227,324,308	25,900		44,700	44,700	204,282,001	23,250	
	.....		.....	199,952,617	22,800		.....	.....	159,428,487	18,140	
	42,800		44,400	185,252,237	21,150		41,000	41,000	168,544,700	19,200	
	30,702		30,702	173,949,572	19,850		20,500	20,500	153,646,054	17,500	
	70,000		70,000	141,535,800	16,150		.....	.....	.....	.....	
	45,300		45,300	135,786,020	15,500		40,950	40,950	172,307,040	19,600	
	40,000		36,000	134,886,292	15,400		41,000	33,000	145,950,224	16,630	
	.....		.....	19,800,573,561	.....		.....	.....	.....	.....	
(o)	129,626	(o)	129,626	725,351,101	82,800	(o)	124,035	(o) 124,035	691,485,448	78,650	
	291,060		291,060	1,147,920,881	131,000		300,700	300,700	1,168,305,375	133,000	
(o)	161,500	(o)	161,500	608,619,727	69,470	(o)	162,900	(o) 162,900	608,371,076	69,300	
	.....		.....	594,098,027	67,800		.....	.....	354,922,052	40,400	
	90,324		.....	287,666,276	32,800		95,507	.....	304,313,972	34,700	
	.....		.....	284,602,140	32,500	(o)	99,060	(o) 78,300	291,426,822	33,200	
	.....		79,695	220,340,490	25,150		93,030	93,030	244,678,940	27,900	
	.....		66,000	212,161,952	24,200		84,000	71,500	228,941,683	26,100	
(o)	41,200	(o)	26,400	154,300,000	17,620		43,000	26,600	179,000,000	20,400	
	39,880		7,560	141,511,652	16,150		46,182	13,327	152,489,148	17,350	
	40,000		.....	133,094,054	15,200		47,000	.....	143,901,864	16,400	
(o)	39,620	(o)	38,770	115,356,150	13,170	(o)	42,620	(o) 39,560	124,932,815	14,260	
	32,650		21,500	103,837,503	11,850		29,500	21,540	99,938,196	11,400	
	.....		10,000	75,368,837	8,600		.....	9,600	78,774,178	8,970	
	.....		.....	70,525,944	8,050		.....	.....	67,439,697	7,670	
	.....		.....	4,149,403,633	.....		.....	.....	.....	.....	

	42,000		42,000	185,041,631							
	48,300		48,300	198,800,090							
	41,250		18,325	230,487,553							
(o)	44,700	(o)	44,700	189,341,440							
	41,700	(o)	36,500	199,783,901							
	39,815		18,815	149,093,897							
	37,000		37,000	179,870,560							
	39,311		.....	171,071,489							
	43,452		11,140	132,960,016							
	27,840		24,600	143,522,953							
	39,000		0	178,076,358							
	29,650		.....	143,502,741							
	90,750		68,100	448,574,681							
(o)	25,130	(o)	41,750	123,216,441							
	32,074		.....	146,433,090							
	29,640		2,840	147,896,790							
	40,403		33,480	141,315,424							
	35,739		21,000	157,710,391							
	32,000		32,000	134,821,422							
	28,119		0	136,633,985							
(o)	31,700	(o)	31,700	128,454,330							
	33,590		29,000	130,452,095							
	26,000		.....	127,308,532							
	26,783		.....	118,526,461							
(o)	23,830	(o)	23,830	106,550,576							
	31,200		.....	130,897,921							
	25,800		25,800	109,489,363							
	26,980		0	100,652,334							
	22,387		77	112,918,808							
	24,034		24,034	110,485,989							
	.....		.....	.....							
	915,945		699,630	4,387,316,157							
	540,500		.....	3,436,436,460							
	485,775		485,075	2,414,375,792							
	307,000		307,000	1,518,632,376							
	285,150		142,700	1,557,929,949							
	83,500		83,500	591,772,849							
	89,100		85,845	412,080,147							
	132,700		132,700	614,665,600							
	57,270		57,270	418,226,810							
	.....		.....	.....							
	.....		74,500	490,148,000							
	.....		.....	.....							
	100,800	(o)	100,800	425,510,139							
	.....		.....	.....							
	.....		.....	173,924,966							
	41,000		41,000	159,873,880							
	.....		.....	.....							
	44,250		44,250	146,048,890							
	45,300		35,600	188,668,281							
	.....		.....	.....							
(o)	122,907	(o)	122,907	691,150,190							
	301,830		301,830	1,198,884,267							
(o)	162,600	(o)	162,600	642,157,665							
	.....		.....	595,733,093							
	102,227		0	333,822,958							
(o)	105,430		95,600	330,309,340							
	98,490		98,490	257,065,945							
	86,300		73,000	250,573,893							
(o)	42,800	(o)	28,900	213,400,000							
	51,287		16,121	159,433,615							
	48,000		0	157,888,334							
(o)	39,798	(o)	38,580	126,174,466							
	34,300		27,300	116,745,039							
	.....		10,100	89,641,092							
	.....		.....	91,042,859							
	.....		.....	.....							

em Elec. Affiliates

w.-hr.)

em Elec. Affiliates

the period for which the 1932 and 1931 peak data

(b) Less energy supplied to other electric companies.

(c) Metropolitan Edison Co. and New Jersey Power & Light Co.

(d) Excluding purchases for surplus sales to other electric corporations but including purchases to supplement output of generating stations for use of customers in Central Hudson territory.

(e) Over one-hour period. Excludes "Firm Peak Service" to Potomac Electric Power Co.

(f) Prior to 1932 Pennsylvania Water & Power Co. only.

(g) Includes 7,060,600 kw.-hr. "Firm Peak Service" to Potomac Electric Power Co.

(h) Includes Broad River Power Co. and Lexington Water Power Co. Prior to 1931 Broad River Power Co. only.

(i) Pennsylvania Electric Co., Erie Lighting Co., Clarion River Power Co. and Youghiogheny Hydro-Electric Corp.

were requested on a 30-minute basis. For that or a shorter period the returns have been entered without comment. Those for a longer period are noted. No distinction has been made between estimated and observed values. In earlier years both instantaneous and 30-minute peaks were called for. Detailed information for those years will be found in corresponding issues of the Supplement.

(j) Includes effect of supp

(k) Includes entire year's Electric Co. and subsi

(m) Instantaneous.

(n) Over 30-minute period

(o) Over one-hour period.

(p) A.-c. input.

(r) Output measured on

(A) Energy produced fro output prior to 1932.

(B) Includes the Southe California Power Co.

21,100		42,500	165,698,907		42,500	172,957,401		30,000					
22,650		47,000	179,709,699	(m)	45,300	185,639,011			153,825,600			126,801,100	109
26,300		42,775	220,440,374			251,759,000			232,877,000		35,105	171,611,000	110
21,600		48,000	195,429,828		45,000	182,112,000	(m)	41,261	172,781,000		46,000	166,244,000	111
22,800	(m)	54,500	238,979,012		51,600	238,200,935							112
17,020		43,220	143,380,401		41,940	144,364,260		30,200	114,835,060	(n)	30,580	116,194,720	113
20,500		38,000	189,781,760	(m)	38,300	198,179,340	(m)	37,200	186,242,950		33,700	174,146,677	114
19,530		42,500	175,304,555		40,500	162,477,080							115
15,180		24,755	139,618,715										116
16,380	(m)	35,630	178,992,370		33,000	170,887,397	(m)	31,720	152,885,453		25,340	114,195,401	117
20,300		45,000	232,425,592										118
16,380		28,700	142,385,334		27,800	122,992,015		30,750	108,519,670				119
51,200		99,070	441,309,468		93,170	424,300,963		84,205	383,337,429		74,100	305,326,889	120
14,080		40,000	129,087,117		26,810	115,530,335							121
16,700		31,000	138,781,877		25,508	103,748,759							122
16,880	(m)	31,390	146,368,000	(m)	23,620	145,405,000	(m)	26,480	122,579,000		24,600	105,634,000	123
16,130			142,532,297										124
18,000		37,400	178,538,313	(m)	41,000	180,016,985		40,000	152,957,600		34,000	131,861,909	125
15,390													126
15,600		27,880	137,457,239		29,700	134,571,700		23,500	122,337,055	(o)	25,000	109,786,578	127
14,660		31,500	142,486,580		31,800	128,665,860		28,100	117,999,180		29,000	107,715,140	128
14,900		40,000	157,500,686		40,000	164,206,522		34,750	151,902,906		31,570	131,017,494	129
14,530		27,150	127,822,014		23,230	103,802,181							130
13,530		27,912	115,634,958		30,300	116,745,731		23,400	93,469,303	(n)	19,000	75,389,189	131
12,160													132
14,940		26,900	121,419,692		29,440	136,213,088							133
12,500	(m)	25,300	103,891,909										134
11,500			113,823,000			119,716,000			104,830,000				135
12,900		23,144	114,480,898		23,065	111,870,280							136
12,600		24,000	112,612,701										137
500,800		937,320	5,077,430,835		847,710	5,071,853,732		794,430	4,429,404,096		746,275	4,133,501,842	138
392,300	(m)	545,600	3,226,014,549	(m)	538,300	3,726,436,341		532,945	3,409,717,522		420,300	3,021,201,950	139
275,600		450,000	2,525,560,158		387,000	2,090,788,460		280,000	1,297,239,606				140
173,400		341,000	2,012,869,376		351,000	2,093,829,000		315,000	2,096,903,000			1,719,820,588	141
177,800		310,000	1,650,636,536	(m)	292,020	1,568,864,226	(m)	279,250	1,450,484,998		256,760	1,354,895,244	142
67,500		83,700	599,257,403		74,800	539,626,687		39,700	516,071,474	(n)	65,600	476,999,100	143
47,000	(m)	89,223	414,195,787	(m)	73,400	445,579,835		74,940	400,668,600		75,834	358,371,100	144
70,200		119,750	598,508,500		124,200	703,982,200		129,000	654,491,510		112,000	511,103,200	145
47,700		50,000	367,130,780		46,000	347,797,680		45,000	343,930,010		43,690	305,415,945	146
													147
55,950			614,411,500			632,261,900			621,423,800			604,597,700	148
													149
48,500		100,200	437,731,126		94,000	418,075,320		94,600	390,564,500		87,400	350,402,700	150
													151
19,850			151,414,019										152
18,250	(m)	40,800	170,619,052		31,000	149,105,920	(m)	31,700	146,233,060	(n)	26,300	125,319,394	153
													154
													155
16,670		41,000	105,805,180										156
21,500		44,860	139,302,262	(m)	29,500	126,876,336	(m)	26,100	104,577,805				157
78,900		121,485	681,822,792		111,140	641,828,127	(m)	107,608	628,832,675	(o)	102,386	606,245,844	158
136,900		303,400	1,228,301,211		304,460	1,217,047,463		298,760	1,177,155,819	(n)	284,660	1,103,063,438	159
73,300		170,000	618,219,724		159,000	599,442,974		150,000	568,889,703	(o)	138,200	544,081,653	160
68,000		197,574	624,776,062		200,698	(p) 664,908,358		195,730	(r) 592,545,223		300,660	(r) 577,710,827	161
38,100		111,750	366,341,403		116,162	384,076,148		110,071	377,326,475	(n)	120,318	371,731,556	162
37,700		86,800	343,354,637		89,800	343,646,828		87,700	333,037,210		99,600	307,432,390	163
29,350		103,194	(F) 270,054,975		91,403	247,473,090		91,576	252,965,140		94,457	243,925,965	164
28,600		71,600	251,780,404		75,400	247,599,220		68,280	230,003,185		75,000	222,131,354	165
24,300		43,000	225,941,425		41,600	209,370,023		40,750	201,191,225		50,500	189,691,700	166
18,200		57,395	170,343,455										167
18,000		48,000	169,134,719		48,000	182,813,761		48,000	184,759,206		54,000	190,485,000	168
14,400		48,000	133,337,207		49,732	140,190,412		46,865	135,530,869	(o)	45,333	137,695,684	169
13,300		24,000	132,339,094		30,000	134,368,264		30,000	127,944,156			123,759,732	170
10,220		25,050	106,660,046		16,500	120,427,038		18,500	109,993,477			114,168,609	171
10,390			124,593,517			156,186,340			162,274,409			148,560,111	172

supply to neighboring system.
year's operations of Wisconsin Valley
ubsidiaries acquired June 5, 1933.

eriod.
riod. Actual or estimated.

on d.c. side.
from "Water Sold" was included in
932. See Supplement, May 6, 1933.
uthern Sierras Power Co., Nevada-
Co. and Yuma Utilities Co.

(C) Canadian Niagara Power Co., Ltd., (see Canada), included in Niagara Hudson Power Corp. System, as is also the St. Lawrence Power Co., Ltd. (Canada).

(D) Mainland system only.

(E) Includes Kentucky & West Virginia Power Co., Inc., and Kingsport Utilities, Inc., in 1933, 1932, 1931 and 1930.

(F) A.-c. output. Prior to 1930 the output given is kw.-hr. generated as d.c. or after conversion to d.c.

(G) On generating plant only.

(H) Electric companies affiliated with the Consolidated Gas Company of New York System include in 1933 New York Edison Co., United Electric Light & Power Co., Brooklyn Edison Co., Inc., New York & Queens Electric Light & Power Co., Yonkers Electric Light & Power Co., Bronx Gas & Electric Co. and Westchester Lighting Co. For companies included in various earlier years see Supplement, May 6, 1933.

(I) Covers the period July 1 to December 31.

(J) Includes Manitoba Power Co., Ltd., also in 1933, 1932 and 1931 Northwestern Power Co., Ltd.

(K) Includes 75,600 kw. supplied as secondary or dump power. Primary peak 280,800 kw.

(L) Operations in 1933 and 1932 not comparable with earlier years. See Supplement, May 6, 1933.

For explanations and comments relating to these statistics the *Electrical World* of May 5, 1934, should be consulted.

The table includes a few companies retained from previous lists although their output in 1933 fell short of 100,000,000 kw.-hr.

Table II—Detailed Data on C of Public Utility Systems H

Line No.	Section and System	Generator Rating, Dec. 31, 1933				Generated and Purchased Output, 1933			Farm or Rural, if not Included Domestic
		Fuel Burning Plants		Hydro Plants					
		No. of Plants	Rating of Generators, Kw.	No. of Plants	Rating of Generators, Kw.	Total Output, Kw.-Hr.	Generated (Net), Kw.-Hr.	Purchased, Kw.-Hr.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	New England States								
1	New England Power Association (Consolidated) System	19	415,250	28	338,180	2,011,436,299	1,499,109,692	512,326,607	700,6
2	The Edison Electric Illuminating Company of Boston	3	375,860	1	*L* 50	1,073,311,339	824,298,494	249,012,845	3,425,5
3	The Connecticut Electric Service Company System	4	109,220	14	58,190	557,824,571	370,076,792	187,747,779	
4	Western Massachusetts Companies System	3	*L* 92,500	9	*L* 99,635	412,011,000	305,984,000	106,027,000	
5	Montaup Electric Company	1	73,000	0	0	407,000,000	384,929,000	22,071,000	
6	Central Maine Power Company	3	*L* 13,572	24	*L* 109,030	405,825,340	388,077,850	17,747,490	6,111,7
7	The Hartford Electric Light Company	2	126,000	1	750	289,961,078	249,986,180	39,974,898	
8	The United Illuminating Company	2	170,000	0	0	263,259,000	263,259,000	0	
9	Blackstone Valley Gas & Electric Company	1	33,500	3	1,750	200,348,632	4,768,943	195,579,689	411,9
10	Public Service Company of New Hampshire	3	43,010	23	39,759	188,638,612	180,320,405	8,318,207	2,989,3
11	New Bedford Gas & Edison Light Company	1	92,000	0	0	179,947,100	179,947,100	0	
12	Cumberland County Power & Light Company	2	36,000	8	25,812	159,327,841	121,439,941	37,887,900	2,053,0
13	The Connecticut Power Company	0	0	2	9,600	143,905,100	45,926,051	97,979,049	
14	Bangor Hydro-Electric Company	0	0	12	31,035	102,703,144	102,703,144	0	
	Totals for section	44	1,579,912	125	713,791	6,395,499,056	4,920,826,592	1,474,672,464	
	Middle Atlantic States								
15	Niagara Hudson Power Corporation System (*e*)	9	*L* 640,822	104	*L* 1,039,047	5,968,613,505	4,913,397,186	1,055,216,319	22,810,6
16	Consolidated Gas Co. of N. Y. System Elec. Affiliates (*f*)	10	2,360,000	0	0	5,015,100,000	4,503,900,000	511,200,000	
17	Philadelphia Electric Company System	9	706,110	3	253,765	2,946,680,745	2,789,226,484	157,454,261	
18	Public Service Electric & Gas Company (N. J.)	5	669,450	0	0	2,038,096,250	1,911,419,110	*g* 126,677,140	
19	The West Penn Electric Company Subsidiaries	28	452,053	12	56,465	1,657,437,659	1,633,405,350	24,032,309	
20	Pennsylvania Power & Light Company	19	320,042	20	44,692	1,402,223,178	1,118,388,465	283,834,713	8,656,3
21	Pennsylvania Wtr. & Pwr. Co. and Safe Harbor Wtr. Pwr. Corp.	1	20,000	2	251,000	1,314,265,000	1,306,943,700	7,321,300	
22	Duquesne Light Company	3	*j* 439,000	0	0	1,211,956,122	1,195,605,910	16,350,212	
23	Assoc. Gas & Elec. System (Eastern Pa. & N. J. Group) (*k*)	4	219,000	5	22,198	713,137,805	482,905,714	230,232,091	
24	N. Y. State Elec. & Gas Corp. Group (Assoc. G. & E. System)	8	57,260	24	14,355	437,172,115	212,391,927	224,780,188	
25	Assoc. Gas & Elec. System (West. Penna. Group) (*l*)	10	101,056	2	48,000	358,791,637	353,356,406	5,435,231	
26	Rochester Gas & Electric Corp	6	77,975	14	48,850	331,452,354	209,298,590	122,153,764	
27	Long Island Lighting Company System	10	170,225	0	0	258,341,534	258,335,800	5,734	
28	Central Hudson Gas & Electric Corporation	1	14,000	6	23,740	245,116,652	97,494,700	147,621,952	4,947,5
29	The Scranton Electric Company	4	*m* 119,500	0	0	239,666,837	239,630,194	36,643	63,7
30	Penn Central Light & Power Company	4	76,100	3	4,520	219,733,000	218,688,076	1,044,924	3,073,3
31	Jersey Central Power & Light Company	7	160,600	1	350	202,881,893	218,589,613	*n* —15,707,720	6,433,9
32	Atlantic City Electric Company	2	*o* 120,000	0	0	193,920,216	193,920,216	0	2,108,6
33	Pennsylvania Power Company	0	0	0	0	141,135,632	0	141,135,632	1,693,3
34	Luzerne County Gas & Electric Corporation	2	55,000	0	0	134,761,462	182,966,435	—48,204,973	39,8
35	Staten Island Edison Corporation	1	47,500	0	0	114,787,730	110,645,330	4,142,400	
	Totals for section (*e*)	143	6,825,693	196	1,806,982	25.145,271,326	22.150,509,206	2,994,762,120	
	East North Central States								
36	Commonwealth Edison Company	4	926,500	0	0	3,801,321,000	1,955,527,000	*p* 1,845,794,000	2,0
37	The Detroit Edison Company	4	867,000	*L* 7	9,160	1,908,671,712	1,888,542,600	20,129,112	9,508,3
38	The Ohio Power Company	10	*s* 380,745	3	1,350	1,804,853,938	1,702,377,829	102,476,109	3,545,0
39	Public Service Company of Northern Illinois	7	395,895	2	800	1,519,982,344	771,246,088	748,736,256	7,978,0
40	Super-Power Company of Illinois	1	*t* 215,000	0	0	1,246,053,446	1,216,081,000	29,972,446	
41	The Cleveland Electric Illuminating Company	4	478,000	0	0	1,240,542,167	1,240,534,967	7,200	
42	Columbia Gas & Electric Corporation System	6	389,250	0	0	1,045,236,270	1,019,563,510	*g* 25,672,760	
43	Chicago District Electric Generating Corporation	1	200,000	0	0	1,042,475,756	1,042,475,756	0	
44	The North American Co. System (Wis.-Michigan Group)	*u* 10	420,389	*u* 10	16,235	974,871,307	874,286,859	100,584,448	
45	Consumers Power Company	7	263,000	38	142,350	928,828,246	844,512,636	*g* 84,315,610	9,049,7
46	Ohio Edison Company	5	311,500	1	2,175	715,770,350	644,646,000	71,124,350	5,232,5
47	Public Service Company of Indiana	8	*L* 123,030	2	4,290	530,805,379	448,333,932	82,471,447	2,104,2
48	Illinois Power & Light Corporation (Illinois)	17	82,110	1	3,590	458,656,166	97,433,445	361,222,721	3,129,6
49	Indiana & Michigan Electric Company	2	93,500	5	22,244	441,374,426	124,413,258	316,961,168	3,011,7
50	Toledo Edison Company	3	160,180	2	6,860	412,111,501	221,313,615	190,797,886	1,362,4
51	Ohio Public Service Company	8	130,100	0	0	408,607,809	306,566,450	102,041,359	2,771,5
52	Northern Indiana Public Service Company	5	103,099	9	*L* 17,145	403,796,004	326,366,388	77,429,616	1,998,8
53	Central Illinois Public Service Company	7	82,530	0	0	302,560,900	146,346,085	*g* 156,214,815	4,679,4
54	Indianapolis Power & Light Company	4	163,200	0	0	297,288,429	240,911,081	56,377,348	7,794,7
55	The Columbus Railway, Power & Light Company	2	132,500	0	0	261,858,960	261,836,100	22,860	573,7
56	Wisconsin Public Service Corporation (*v*)	5	42,900	18	45,230	255,942,597	234,989,557	20,953,040	4,361,3
57	Wisconsin Power & Light Company	6	49,604	33	37,423	252,759,140	206,398,670	46,360,470	6,014,9
58	Central Illinois Light Company	4	94,050	0	0	248,224,980	247,954,780	270,200	1,039,6
59	City of Detroit, Public Lighting Commission	1	80,000	0	0	183,043,585	166,395 000	16,648,585	
60	City of Cleveland, Dept. of Public Utilities	1	50,000	0	0	157,233,300	157,233,300	0	

Supplement to ELECTRICAL WORLD, May 5, 1934
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n Generator Rating, Output, Customers and Distribution of I
Having an Output Exceeding 100,000,000 Kw.-Hr. During

Distribution of Output in Kilowatt-Hours, 1933

rm or ural, not uded in mestic (10)	Domestic Service (11)	Commercial Small Light and Power (Retail) (12)	Commercial Large Light and Power (Wholesale) (13)	Municipal Service (Street Lighting, etc.) (14)	Other Sales to Ultimate Consumers (15)	Elec. R'way Operation (Including Company-Owned) (16)	Other Public Utilities (Including Municipal Systems) (17)	Used by Company (18)	Not Accounted for (Losses) (19)
700,678	189,803,870	123,494,962	649,205,426	39,741,758	.....	61,949,374	619,735,159	44,818,663	281,986,409
425,582	178,718,473	181,932,077	269,559,649	30,941,563	.....	5,542,000	239,283,326	4,989,467	158,919,202
.....	80,030,899	34,344,712	200,458,284	9,521,307	.....	41,422,840	96,409,665	17,421,289	78,215,575
.....	43,730,000	27,832,000	115,219,000	9,533,000	9,746,000	21,188,000	111,417,000	5,072,000	68,274,000
0	0	0	0	0	0	0	407,000,000	0	*b*
111,751	23,982,655	18,520,070	225,580,398	8,072,494	.....	4,102,700	42,514,280	19,820,522	57,120,470
.....	44,072,824	56,866,756	38,531,180	6,238,790	0	19,023,500	92,172,667	2,606,980	30,448,381
.....	53,058,311	45,450,856	118,890,629	7,424,004	.....	.....	5,862,000	4,008,000	28,565,200
411,993	15,236,823	13,242,153	118,944,090	9,140,686	.....	.....	17,645,612	518,303	25,208,972
989,393	16,890,220	11,681,033	44,527,334	5,521,020	.....	5,894,448	71,765,802	7,326,157	22,043,205
.....	12,026,128	7,510,269	114,823,753	3,734,785	.....	.....	22,830,548	2,281,598	16,740,019
053,037	18,817,751	17,644,510	72,399,792	4,392,228	806,900	12,315,167	6,502,300	3,049,282	21,346,874
.....	13,744,091	6,275,565	22,935,439	1,515,342	.....	.....	92,964,361	813,934	5,656,368
..... *c*	12,847,268	*c, d*	*d* 60,451,937	1,194,638	.....	3,184,960	8,008,793	565,736	16,449,812
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
310,619	362,127,185	318,633,776	2,818,430,257	103,877,886	.....	133,789,497	1,307,910,253	44,485,279	856,548,753
.....	801,700,000	811,300,000	1,998,300,000	222,900,000	.....	392,300,000	2,200,000	42,400,000	744,000,000
.....	332,389,418	258,126,376	1,095,894,557	41,256,124	.....	550,253,618	296,646,500	26,794,423	345,319,729
..... *h*	340,079,281	423,974,898	720,374,579	59,469,320	312,923	162,519,426	1,575,760	21,289,928	308,500,135
.....	144,757,001	86,653,857	1,109,125,538	21,142,763	.....	62,269,046	13,415,107	.....	220,074,347
656,312	135,632,723	114,857,255	810,493,193	47,233,244	.....	53,515,946	65,494,201	5,724,195	160,616,109
0	0	0	0	0	0	0	1,240,876,700	.....	73,388,300
.....	194,393,365	97,569,690	572,708,485	29,609,000	50,513	171,572,640	4,356,515	3,695,554	138,000,360
.....	62,387,255	40,320,417	269,584,949	11,730,094	.....	26,655,187	189,441,391	12,299,637	100,718,875
.....	74,893,415	34,491,403	174,130,561	21,735,452	.....	2,085,434	68,878,233	2,736,340	58,221,277
.....	42,522,126	25,836,135	175,397,531	5,753,817	.....	4,941,030	33,939,093	3,453,661	66,948,244
.....	57,082,729	68,496,520	79,056,794	29,021,313	.....	26,392,638	1,906,367	19,472,198	50,023,795
.....	74,421,393	35,244,865	50,399,292	23,361,868	243,168	14,070,000	1,259,176	6,255,265	53,086,507
947,521	29,258,643	27,907,083	36,417,532	11,135,806	.....	963,000	99,284,100	3,153,949	32,049,018
763,739	29,271,081	28,258,085	128,805,697	5,381,928	.....	18,462,714	1,889,445	927,608	26,606,540
973,365	22,835,621	12,643,306	112,466,045	3,223,109	.....	9,501,485	23,513,816	1,955,676	30,520,577
333,906	40,168,264	16,761,503	58,507,683	20,473,820	389,157	9,930,890	4,626,800	6,075,947	39,513,923
108,688	35,378,514	27,279,404	79,841,169	8,753,939	.....	77,578	1,486,000	2,132,344	36,862,580
293,320	17,383,395	14,663,990	84,457,922	2,849,897	.....	3,024,350	4,552,020	702,685	11,808,053
339,866	13,320,953	6,356,920	86,808,694	2,636,842	.....	9,824,875	815,572	1,525,948	13,431,792
.....	20,988,573	8,287,679	34,282,003	11,483,735	.....	20,198,994	3,227,500	1,000,804	15,318,442
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,000	538,833,000	432,018,000	1,343,485,000	112,696,000	33,000	811,004,000	*q* 22,687,000	19,568,000	520,995,000
308,365	301,015,812	373,012,737	780,081,130	28,296,319	41,787,536	44,116,625	62,141,688	20,215,900	248,495,600
145,095	83,665,229	80,954,619	549,681,232	12,184,277	25,326,506	8,537,528	881,119,595	4,998,966	154,840,891
278,022	140,699,001	78,522,235	262 011,046	89,563,918	.....	80,594,383	695,759,846	12,297,735	152,556,158
0	0	0	0	0	0	0	1,246,053,446	0	0
.....	176,956,559	144,983,188	502,084,612	20,651,552	5,658,034	146,308,765	81,939,329	5,617,359	156,342,769
.....	155,230,735	108,338,328	385,553,418	62,851,037	.....	101,603,737	92,975,855	15,644,492	123,038,668
0	0	0	0	0	0	0	1,042,475,756	0	0
.....	160,330,339	106,518,221	351,433,415	28,824,100	578,286	116,023,844	55,122,511	10,464,404	145,576,187
149,749	152,869,164	154,791,090	354,333,871	24,338,340	.....	14,255,777	22,380,404	11,479,687	185,330,164
332,589	86,935,276	100,205,803	220,197,779	13,422,697	.....	33,152,694	167,299,234	3,628,553	85,695,725
304,266	40,607,936	30,800,670	137,127,673	18,628,613	.....	56,678,502	154,321,593	5,141,566	85,394,560
229,624	59,467,822	46,900,347	183,267,806	20,476,608	.....	40,361,380	4,698,233	8,388,630	91,965,716
111,742	25,437,779	23,826,306	55,424,372	4,484,016	.....	10,486,655	274,186,260	1,944,856	42,572,440
662,430	40,126,316	39,896,605	194,529,084	10,559,330	.....	43,298,252	23,769,118	2,595,225	55,975,141
771,506	36,899,590	32,787,169	219,489,672	6,532,458	.....	.....	55,905,341	4,150,785	50,071,288
998,829	27,292,064	17,394,255	181,330,541	12,811,539	.....	25,527,654	62,319,720	8,670,819	66,450,583
979,424	42,076,059	43,437,824	86,274,073	17,473,202	.....	.....	35,973,995	12,303,439	60,342,884
994,759	42,603,943	73,762,051	112,896,086	17,477,541	.....	.....	700,320	1,305,587	40,748,142
773,797	46,170,412	35,051,309	73,116,741	1,943,839	468,878	26,223,720	55,016,505	1,405,867	21,887,892
761,367	23,034,041	20,142,125	110,872,804	7,584,142	.....	3,696,570	44,868,972	2,253,117	39,129,459
114,973	28,766,281	16,807,793	32,435,047	9,883,237	.....	2,099,156	107,779,180	4,712,156	44,261,317
939,610	26,402,132	50,866,382	103,966,213	5,070,503	.....	2,300,300	32,904,796	894,278	24,780,766
0	0	1,343,969	16,278,000	76,068,135	0	76,391,440	0	.....	12,962,041
.....	25,132,275	17,956,164	52,153,933	31,852,894	.....	0	7,793,284	.....	22,344,750

Num

Farm or Rural if Not Included in Domestic (20)	Domestic (21)	Commercial Small Light and Power (Retail) (22)
397	409,620	61,306
a 2,032	*a* 307,613	*a* 69,480
.....	123,637	16,806
.....	72,905	11,581
0	0	0
12,951	50,003	10,754
.....	60,309	9,556
.....	102,104	14,089
282	40,123	5,789
4,588	39,799	7,265
.....	34,178	4,889
3,777	34,483	6,170
.....	18,835	2,918
..... *c*	24,612	*c, d*
.....	.....	.....
27,579	530,382	82,266
.....	*a* 1,784,057	*a* 398,821
.....	522,101	109,395
.....	*i* 845,908	*i*
.....	241,419	40,319
9,986	278,485	50,689
0	0	0
.....	270,961	29,303
.....	119,702	20,273
.....	124,216	18,745
.....	91,428	13,653
.....	105,217	12,408
.....	121,322	17,780
3,474	50,123	12,322
36	64,933	11,521
5,417	43,544	6,240
9,170	64,689	10,762
2,734	64,727	14,227
2,140	32,650	4,667
44	31,357	3,229
.....	36,882	5,026
.....	.....	.....
5	*r* 779,500	119,793
12,408	438,058	75,456
4,577	168,314	32,394
9,098	229,544	32,278
0	0	0
.....	260,536	33,281
.....	261,393	38,084
0	0	0
.....	259,229	42,251
13,696	246,975	48,172
6,780	142,982	20,809
4,329	92,027	17,488
3,480	149,091	26,515
4,007	49,612	8,279
2,463	77,542	10,369
3,526	61,667	10,651
3,310	58,057	10,436
6,700	103,431	27,111
11,783	80,463	11,281
1,017	81,767	9,306
6,284	51,129	11,221
8,902	65,910	12,651
1,521	43,610	10,481
0	0	1
.....	40,890	6,081

Supplement to ELECTRICAL WORLD, May 5, 1934
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e II—Detailed Data on Generator Rating, Output, Custome
ublic Utility Systems Having an Output Exceeding 100,0

ec. 31, 1933			Generated and Purchased Output, 1933			Distribution of Output in Kilowatt-Hours, 1933								
ydro Plants														
ts		Rating of Generators, Kw. (6)	Total Output, Kw.-Hr. (7)	Generated (Net), Kw.-Hr. (8)	Purchased, Kw.-Hr. (9)	Farm or Rural, if not Included in Domestic (10)	Domestic Service (11)	Commercial Small Light and Power (Retail) (12)	Commercial Large Light and Power (Wholesale) (13)	Municipal Service (Street Lighting, etc.) (14)	Other Sales to Ultimate Consumers (15)	Elec. R'way Operation (Including Company-Owned) (16)	Other Pu Utilitie (Includi Municip System (17)
		338,180	2,011,436,299	1,499,109,692	512,326,607	700,678	189,803,870	123,494,962	649,205,426	39,741,758	.....	61,949,374	619,735
	L	50	1,073,311,339	824,298,494	249,012,845	3,425,582	178,718,473	181,932,077	269,559,649	30,941,563	.....	5,542,000	239,283
		58,190	557,824,571	370,076,792	187,747,779	.....	80,030,899	34,344,712	200,458,284	9,521,307	.....	41,422,840	96,409
	L	99,635	412,011,000	305,984,000	106,027,000	.....	43,730,000	27,832,000	115,219,000	9,533,000	9,746,000	21,188,000	111,417
		0	407,000,000	384,929,000	22,071,000	0	0	0	0	0	0	0	407,000
	L	109,030	405,825,340	388,077,850	17,747,490	6,111,751	23,982,655	18,520,070	225,580,398	8,072,494	.....	4,102,700	42,514
		750	289,961,078	249,986,180	39,974,898	.....	44,072,824	56,866,756	38,531,180	6,238,790	0	19,023,500	92,172
		0	263,259,000	263,259,000	0	.....	53,058,311	45,450,856	118,890,629	7,424,004	.....	.....	5,862
		1,750	200,348,632	4,768,943	195,579,689	411,993	15,236,823	13,242,153	118,944,090	9,140,686	.....	.....	17,645
		39,759	188,638,612	180,320,405	8,318,207	2,989,393	16,890,220	11,681,033	44,527,334	5,521,020	.....	5,894,448	71,765
		0	179,947,100	179,947,100	0	.....	12,026,128	7,510,269	114,823,753	3,734,785	.....	.....	22,830
		25,812	159,327,841	121,439,941	37,887,900	2,053,037	18,817,751	17,644,510	72,399,792	4,392,228	806,900	12,315,167	6,502
		9,600	143,905,100	45,926,051	97,979,049	.....	13,744,091	6,275,565	22,935,439	1,515,342	.....	.....	92,964
		31,035	102,703,144	102,703,144	0	.....	c 12,847,268	c, d	d 60,451,937	1,194,638	.....	3,184,960	8,008
		713,791	6,395,499,056	4,920,826,592	1,474,672,464	.....	.....	.....	.....	.....	.....	.....	.....
	L	1,039,047	5,968,613,505	4,913,397,186	1,055,216,319	22,810,619	362,127,185	318,633,776	2,818,430,257	103,877,886	.....	133,789,497	1,307,910
		0	5,015,100,000	4,503,900,000	511,200,000	.....	801,700,000	811,300,000	1,998,300,000	222,900,000	.....	392,300,000	2,200
		253,765	2,946,680,745	2,789,226,484	157,454,261	.....	332,389,418	258,126,376	1,095,894,557	41,256,124	.....	550,253,618	296,646
		0	2,038,096,250	1,911,419,110	g 126,677,140	.....	h 340,079,281	423,974,898	720,374,579	59,469,320	312,923	162,519,426	1,575
		56,465	1,657,437,659	1,633,405,350	24,032,309	.....	144,757,001	86,653,857	1,109,125,538	21,142,763	.....	62,269,046	13,415
		44,692	1,402,223,178	1,118,388,465	283,834,713	8,656,312	135,632,723	114,857,255	810,493,193	47,233,244	.....	53,515,946	65,494
		251,000	1,314,265,000	1,306,943,700	7,321,300	0	0	0	0	0	0	0	1,240,876
		0	1,211,956,122	1,195,605,910	16,350,212	.....	194,393,365	97,569,690	572,708,485	29,609,000	50,513	171,572,640	4,356
		22,198	713,137,805	482,905,714	230,232,091	.....	62,387,255	40,320,417	269,584,949	11,730,094	.....	26,655,187	189,441
		14,355	437,172,115	212,391,927	224,780,188	.....	74,893,415	34,491,403	174,130,561	21,735,452	.....	2,085,434	68,878
		48,000	358,791,637	353,356,406	5,435,231	.....	42,522,126	25,836,135	175,397,531	5,753,817	.....	4,941,030	33,939
		48,850	331,452,354	209,298,590	122,153,764	.....	57,082,729	68,496,520	79,056,794	29,021,313	.....	26,392,638	1,906
		0	258,341,534	258,335,800	5,734	.....	74,421,393	35,244,865	50,399,292	23,361,868	243,168	14,070,000	1,259
		23,740	245,116,652	97,494,700	147,621,952	4,947,521	29,258,643	27,907,083	36,417,532	11,135,806	.....	963,000	99,284
		0	239,666,837	239,630,194	36,643	63,739	29,271,081	28,258,085	128,805,697	5,381,928	.....	18,462,714	1,889
		4,520	219,733,000	218,688,076	1,044,924	3,073,365	22,835,621	12,643,306	112,466,045	3,223,109	.....	9,501,485	23,513
		350	202,881,893	218,589,613	n —15,707,720	6,433,906	40,168,264	16,761,503	58,507,683	20,473,820	389,157	9,930,890	4,626
		0	193,920,216	193,920,216	0	2,108,688	35,378,514	27,279,404	79,841,169	8,753,939	.....	77,578	1,486
		0	141,135,632	0	141,135,632	1,693,320	17,383,395	14,663,990	84,457,922	2,849,897	.....	3,024,350	4,552
		0	134,761,462	182,966,435	—48,204,973	39,866	13,320,953	6,356,920	86,808,694	2,636,842	.....	9,824,875	815
		0	114,787,730	110,645,330	4,142,400	.....	20,988,573	8,287,679	34,282,003	11,483,735	.....	20,198,994	3,227
		1,806,982	25.145,271,326	22.150,509,206	2,994,762,120	.....	.....	.....	.....	.....	.....	.....	.....
		0	3,801,321,000	1,955,527,000	p 1,845,794,000	2,000	538,833,000	432,018,000	1,343,485,000	112,696,000	33,000	811,004,000	q 22,687
		9,160	1,908,671,712	1,888,542,600	20,129,112	9,508,365	301,015,812	373,012,737	780,081,130	28,296,319	41,787,536	44,116,625	62,141
		1,350	1,804,853,938	1,702,377,829	102,476,109	3,545,095	83,665,229	80,954,619	549,681,232	12,184,277	25,326,506	8,537,528	881,119
		800	1,519,982,344	771,246,088	748,736,256	7,978,022	140,699,001	78,522,235	262 011,046	89,563,918	.....	80,594,383	695,759
		0	1,246,053,446	1,216,081,000	29,972,446	0	0	0	0	0	0	0	1,246,053
		0	1,240,542,167	1,240,534,967	7,200	.....	176,956,559	144,983,188	502,084,612	20,651,552	5,658,034	146,308,765	81,939
		0	1,045,236,270	1,019,563,510	g 25,672,760	.....	155,230,735	108,338,328	385,553,418	62,851,037	.....	101,603,737	92,975
		0	1,042,475,756	1,042,475,756	0	0	0	0	0	0	0	0	1,042,475
		16,235	974,871,307	874,286,859	100,584,448	.....	160,330,339	106,518,221	351,433,415	28,824,100	578,286	116,023,844	55,122
		142,350	928,828,246	844,512,636	g 84,315,610	9,049,749	152,869,164	154,791,090	354,333,871	24,338,340	.....	14,255,777	22,380
		2,175	715,770,350	644,646,000	71,124,350	5,232,589	86,935,276	100,205,803	220,197,779	13,422,697	.....	33,152,694	167,299
		4,290	530,805,379	448,333,932	82,471,447	2,104,266	40,607,936	30,800,670	137,127,673	18,628,613	.....	56,678,502	154,321
		3,590	458,656,166	97,433,445	361,222,721	3,129,624	59,467,822	46,900,347	183,267,806	20,476,608	.....	40,361,380	4,698
		22,244	441,374,426	124,413,258	316,961,168	3,011,742	25,437,779	23,826,306	55,424,372	4,484,016	.....	10,486,655	274,186
		6,860	412,111,501	221,313,615	190,797,886	1,362,430	40,126,316	39,896,605	194,529,084	10,559,330	.....	43,298,252	23,769
		0	408,607,809	306,566,450	102,041,359	2,771,506	36,899,590	32,787,169	219,489,672	6,532,458	.....	.....	55,905
	L	17,145	403,796,004	326,366,388	77,429,616	1,998,829	27,292,064	17,394,255	181,330,541	12,811,539	.....	25,527,654	62,319
		0	302,560,900	146,346,085	g 156,214,815	4,679,424	42,076,059	43,437,824	86,274,073	17,473,202	.....	.....	35,973
		0	297,288,429	240,911,081	56,377,348	7,794,759	42,603,943	73,762,051	112,896,086	17,477,541	.....	.....	700
		0	261,858,960	261,836,100	22,860	573,797	46,170,412	35,051,309	73,116,741	1,943,839	468,878	26,223,720	55,016
		45,230	255,942,597	234,989,557	20,953,040	4,361,367	23,034,041	20,142,125	110,872,804	7,584,142	.....	3,696,570	44,868
		37,423	252,759,140	206,398,670	46,360,470	6,014,973	28,766,281	16,807,793	32,435,047	9,883,237	.....	2,099,156	107,779
		0	248,224,980	247,954,780	270,200	1,039,610	26,402,132	50,866,382	103,966,213	5,070,503	.....	2,300,300	32,904
		0	183,043,585	166,395 000	16,648,585	0	0	1,343,969	16,278,000	76,068,135	0	76,391,440	
		0	157,233,300	157,233,300	0	.....	25,132,275	17,956,164	52,153,933	31,852,894	.....	0	7,793

mers and Distribution of Energy
0,000,000 Kw.-Hr. During 1933

This tabulation is based on the operating company as the unit. Group statistics are given in a few instances for properties which, though distinct corporate entities, are operated in each case as a single physical system.

r Public tilities cluding nicipal stems) (17)	Used by Company (18)	Not Accounted for (Losses) (19)	Number of Customers, Dec. 31, 1933: Farm or Rural if Not Included in Domestic (20)	Domestic (21)	Commercial Small Light and Power (Retail) (22)	Commercial Large Light and Power (Wholesale) (23)	Municipal Service (Street Lighting, etc.) (24)	Other Ultimate Consumers (25)	Electric Railway Operation (26)	Other Public Utilities Including Municipal (27)	Line No. (28)
9,735,159	44,818,663	281,986,409	397	409,620	61,306	11,784	151	.....	9	73	1
9,283,326	4,989,467	158,919,202	*a* 2,032	*a* 307,613	*a* 69,480	*a* 545	*a* 40	.....	*a* 1	*a* 10	2
6,409,665	17,421,289	78,215,575	.....	123,637	16,806	2,535	72	.....	3	19	3
1,417,000	5,072,000	68,274,000	.....	72,905	11,581	2,659	39	1	4	8	4
7,000,000	0	*b*	0	0	0	0	0	0	0	4	5
2,514,280	19,820,522	57,120,470	12,951	50,003	10,754	1,929	1,043	.....	1	10	6
2,172,667	2,606,980	30,448,381	.....	60,309	9,556	66	26	0	1	5	7
5,862,000	4,008,000	28,565,200	.....	102,104	14,089	3,648	.....	.....	.....	.....	8
7,645,612	518,303	25,208,972	282	40,123	5,789	432	211	.....	.....	3	9
1,765,802	7,326,157	22,043,205	4,588	39,799	7,265	1,676	517	.....	4	23	10
2,830,548	2,281,598	16,740,019	.....	34,178	4,889	971	249	.....	.....	1	11
6,502,300	3,049,282	21,346,874	3,777	34,483	6,170	1,767	368	1	1	2	12
2,964,361	813,934	5,656,368	.....	18,835	2,918	849	14	.....	.....	6	13
8,008,793	565,736	16,449,812	.....	*c* 24,612	*c, d*	*d* 4,322	54	.....	1	6	14
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
7,910,253	44,485,279	856,548,753	27,579	530,382	82,266	4,346	807	.....	17	74	15
2,200,000	42,400,000	744,000,000	.....	*a* 1,784,057	*a* 398,821	*a* 42,539	*a* 2,576	.....	8	1	16
6,646,500	26,794,423	345,319,729	.....	522,101	109,395	3,744	211	.....	9	20	17
1,575,760	21,289,928	308,500,135	.....	*i* 845,908	*i*	*i*	218	*i*	6	2	18
3,415,107	.....	220,074,347	.....	241,419	40,319	6,503	430	.....	14	24	19
5,494,201	5,724,195	160,616,109	9,986	278,485	50,689	4,337	2,888	.....	8	33	20
0,876,700	.....	73,388,300	0	0	0	0	0	0	0	5	21
4,356,515	3,695,554	138,000,360	.....	270,961	29,303	1,864	158	17	1	5	22
9,441,391	12,299,637	100,718,875	.....	119,702	20,273	3,341	748	.....	3	14	23
8,878,233	2,736,340	58,221,277	.....	124,216	18,745	3,825	1,269	.....	2	23	24
3,939,093	3,453,661	66,948,244	.....	91,428	13,653	2,719	861	.....	2	13	25
1,906,367	19,472,198	50,023,795	.....	105,217	12,408	884	904	.....	9	8	26
1,259,176	6,255,265	53,086,507	.....	121,322	17,780	6,252	214	.....	1	1	27
9,284,100	3,153,949	32,049,018	3,474	50,123	12,322	108	243	.....	1	11	28
1,889,445	927,608	26,606,540	36	64,933	11,521	214	31	.....	2	6	29
3,513,816	1,955,676	30,520,577	5,417	43,544	6,240	1,710	84	.....	1	13	30
4,626,800	6,075,947	39,513,923	9,170	64,689	10,762	1,352	881	5	1	4	31
1,486,000	2,132,344	36,862,580	2,734	64,727	14,227	1,812	148	.....	1	1	32
4,552,020	702,685	11,808,053	2,140	32,650	4,667	114	36	.....	2	11	33
815,572	1,525,948	13,431,792	44	31,357	3,229	870	26	.....	2	2	34
3,227,500	1,000,804	15,318,442	.....	36,882	5,026	823	335	.....	2	1	35
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,687,000	19,568,000	520,995,000	5	*r* 779,500	119,793	3,112	4	15	6	1	36
2,141,688	20,215,900	248,495,600	12,408	438,058	75,456	420	156	108	2	2	37
1,119,595	4,998,966	154,840,891	4,577	168,314	32,394	427	181	1,929	7	57	38
5,759,846	12,297,735	152,556,158	9,098	229,544	32,278	497	2,384	.....	7	10	39
6,053,446	0	0	0	0	0	0	0	0	0	4	40
1,939,329	5,617,359	156,342,769	.....	260,536	33,281	522	124	319	3	5	41
2,975,855	15,644,492	123,038,668	.....	261,393	38,084	6,375	1,872	.....	13	12	42
2,475,756	0	0	0	0	0	0	0	0	0	2	43
5,122,511	10,464,404	145,576,187	.....	259,229	42,251	5,068	298	97	2	17	44
2,380,404	11,479,687	185,330,164	13,696	246,975	48,172	678	262	.....	3	13	45
7,299,234	3,628,553	85,695,725	6,780	142,982	20,809	253	50	.....	19	17	46
4,321,593	5,141,566	85,394,560	4,329	92,027	17,488	3,112	1,511	.....	5	48	47
4,698,233	8,388,630	91,965,716	3,480	149,091	26,515	5,386	1,002	.....	.....	26	48
4,186,260	1,944,856	42,572,440	4,007	49,612	8,279	330	33	.....	18	12	49
3,769,118	2,595,225	55,975,141	2,463	77,542	10,369	1,630	24	.....	9	11	50
5,905,341	4,150,785	50,071,288	3,526	61,667	10,651	254	28	.....	.....	12	51
2,319,720	8,670,819	66,450,583	3,310	58,057	10,436	2,012	838	.....	3	18	52
5,973,995	12,303,439	60,342,884	6,700	103,431	27,113	152	1,628	.....	.....	13	53
700,320	1,305,587	40,748,142	11,783	80,463	11,281	217	10	.....	.....	1	54
5,016,505	1,405,867	21,887,892	1,017	81,767	9,300	661	138	.....	1	5	55
4,868,972	2,253,117	39,129,459	6,284	51,129	11,221	2,691	181	.....	.....	15	56
7,779,180	4,712,156	44,261,317	8,902	65,910	12,651	3,502	251	.....	.....	48	57
2,904,796	894,278	24,780,766	1,521	43,610	10,481	201	33	.....	2	5	58
0	.....	12,962,041	0	0	13	1	.....	0	1	0	59
7,793,284	.....	22,344,750	.....	40,890	6,088	397	.....	.....	0	147	60

a Bills rendered in December. (In Consol. Gas Co. of N. Y. Group, Yonkers Electric Light & Power Co. and Westchester Lighting Co. report meters.)

b All energy sold at low-tension bus of generating station.

c Commercial light combined with domestic service.

d Retail combined with wholesale.

e Canadian Niagara Power Co., Ltd. (see Canada), included in Niagara Hudson Power Corp. System; also St. Lawrence Power Co., Ltd., one hydro plant, 2,000 kw., generated 9,620,429 kw.-hr. (Canada).

f Includes New York Edison Co., United Electric Light & Power Co., Brooklyn Edison Co., Inc., New York & Queens Electric Light & Power Co., Yonkers Electric Light & Power Co., Bronx Gas & Electric Co. and Westchester Lighting Co.

g Net.

h Residence rate.

i Commercial, small light and power (retail), commercial large light and power (wholesale) and other sales combined with domestic service.

j Also one plant, 5,000 kw., operated by purchased steam.

k Metropolitan Edison Co., and New Jersey Power & Light Co.

l Pennsylvania Electric Co., Erie Lighting Co., Clarion River Power Co. and Youghiogheny Hydro-Electric Corp.

m Includes company's share of jointly owned plant (Stanton).

n Includes as credit 19,907,100 kw.-hr. economy flow to other companies.

o Includes company's share of jointly owned plant (Deepwater).

p Net; 1,881,189,000 kw.-hr. total purchased less 35,395,000 kw.-hr. sales for resale outside of Chicago.

q Sold to other public utilities in Chicago. (See also note *p*.)

r Includes 36,817 hall light

46	Ohio Edison Company											
47	Public Service Company of Indiana	8	L	123,030	2		4,290	530,805,379	448,333,932		82,471,447	2,104,26
48	Illinois Power & Light Corporation (Illinois)	17		82,110	1		3,590	458,656,166	97,433,445		361,222,721	3,129,62
49	Indiana & Michigan Electric Company	2		93,500	5		22,244	441,374,426	124,413,258		316,961,168	3,011,74
50	Toledo Edison Company	3		160,180	2		6,860	412,111,501	221,313,615		190,797,886	1,362,43
51	Ohio Public Service Company	8		130,100	0		0	408,607,809	306,566,450		102,041,359	2,771,50
52	Northern Indiana Public Service Company	5		103,099	9	L	17,145	403,796,004	326,366,388		77,429,616	1,998,82
53	Central Illinois Public Service Company	7		82,530	0		0	302,560,900	146,346,085	g	156,214,815	4,679,42
54	Indianapolis Power & Light Company	4		163,200	0		0	297,288,429	240,911,081		56,377,348	7,794,75
55	The Columbus Railway, Power & Light Company	2		132,500	0		0	261,858,960	261,836,100		22,860	573,79
56	Wisconsin Public Service Corporation (v)	5		42,900	18		45,230	255,942,597	234,989,557		20,953,040	4,361,36
57	Wisconsin Power & Light Company	6		49,604	33		37,423	252,759,140	206,398,670		46,360,470	6,014,97
58	Central Illinois Light Company	4		94,050	0		0	248,224,980	247,954,780		270,200	1,039,61
59	City of Detroit, Public Lighting Commission	1		80,000	0		0	183,043,585	166,395 000		16,648,585	
60	City of Cleveland, Dept. of Public Utilities	1		50,000	0		0	157,233,300	157,233,300		0	
61	Northern Indiana Power Company	6		24,900	1		384	138,628,416	1,110,383		137,518,033	1,449,12
62	Indiana General Service Company	3		40,950	0		0	130,082,544	5,824,732		124,257,812	1,702,27
63	Indiana Service Corporation	1		31,000	0		0	126,644,400	37,760,300		88,884,100	1,634,69
64	Moline-Rock Island Manufacturing Company	2		78,200	0		0	114,354,156	82,608,689		31,745,467	
	Totals for section	144		6,409,132	132		309,236	21,352,579,228	16,513,590,010		4,838,989,218	
	West North Central States											
65	The North American Co. Sys. (Mo., Ill. and Iowa Group)	7		457,170	2		264,000	1,696,604,927	1,696,545,926		59,001	
66	Northern States Power Company (Del.) Subsidiaries	24		290,516	27		146,735	963,928,433	910,684,051		53,244,382	3,891,21
67	Kansas City Power & Light Company	3		258,225	0		0	596,988,080	594,767,997		2,220,083	2,155,71
68	Nebraska Power Company	1		98,000	0		0	314,902,500	314,902,500		0	1,275,80
69	Minnesota Power & Light Company	4		30,300	11		94,911	306,676,549	306,615,949		60,600	614,12
70	Kansas Gas & Electric Company	2		70,000	0		0	225,142,400	224,729,900		412,500	1,804,74
71	Empire District Electric Company	2	w	67,600	4		19,720	179,266,869	175,183,010		4,083,859	667,35
72	Des Moines Electric Light Company	3		91,940	1		800	178,667,276	178,667,276		0	1,076,83
73	Sioux City Gas & Electric Co., Iowa Pub. Serv. Co. System	21		71,646	4		2,025	152,802,616	140,107,353		12,695,263	2,362,26
74	The Kansas Power & Light Company	5		74,725	0		0	139,099,428	133,605,968		5,493,460	1,018,13
75	Interstate Power Company and Subsidiaries	15		62,664	12		6,545	128,431,109	93,086,233		35,344,876	2,742,57
76	Iowa Electric Light & Power Company	14		61,818	2		1,460	126,074,818	125,647,688		427,130	1,716,31
77	The United Power & Light Corporation (of Kansas)	11		44,335	5		3,895	114,234,330	103,112,212		11,122,118	1,017,20
	Totals for section	112		1,678,939	68		540,091	5,122,819,335	4,997,656,063		125,163,272	
	South Atlantic States											
78	Duke Power Company	9	L	306,725	41	L	598,730	1,765,737,132	1,405,454,505		360,282,627	y
79	Appalachian Electric Power Company (z)	11		346,575	5		44,900	1,335,577,926	989,068,231		346,509,695	2,074,3
80	Georgia Power Company	23	L	93,574	25	L	290,187	1,252,193,279	1,022,353,205	g	229,840,074	
81	Carolina Power & Light Company	4		46,750	10		205,450	966,328,322	570,515,722		395,812,600	899,9
82	Consolidated Gas, Electric Light & Power Co. of Baltimore	3		238,450	0		0	897,675,028	83,835,430		813,839,598	
83	The North American Co. System (District of Columbia Group)	2		220,000	0		0	562,432,866	425,272,266		137,160,600	3,355,8
84	Virginia Electric & Power Company	8		127,834	9		28,970	506,712,794	410,392.934		96,319,860	3,583,1
85	Assoc. Gas & Elec. System (South Carolina Group) (C)	1		72,500	4		154,705	463.031,379	453,315,446		9,715,933	
86	Virginia Public Service Company	6		67,926	13	L	14,426	217,014,594	195,058,695		21,955,899	7,932,2
87	Florida Power & Light Company	40		139,509	0		0	191,185,000	187,279,000		3,906,000	3,296,4
88	Tampa Electric Company	2		35,000	1		600	143,553,046	136,786,287		6,766,759	974,5
89	Delaware Power & Light Company	0		0	0		0	120,052,212	0		120,052,212	
90	South Carolina Power Company	6		20,097	2		16,275	101,504,990	101,322,190	g	182,800	422,0
91	Florida Power Corporation and Subsidiaries	8		44,224	3		14,040	95,226,852	94,051,572		1,175,280	631,3
92	Wheeling Electric Company	1		9,000	0		0	92,039,873	1,394,300		90,645,573	317,2
	Totals for section	124		1,768,164	113		1,368,283	8,710,265,293	6,076,099,783		2,634,165,510	
	East South Central States											
93	Alabama Power Company	14	L	164,409	6		398,300	1,601,049,505	1,398,968,896	g	202,080,609	9,809,4
94	The Tennessee Electric Power Company	15	L	109,292	14		133,123	575,047,467	482,305,467	g	92,742,000	
95	Louisville Gas & Electric Company (Del.) Subsidiaries	3		112,020	1		80,320	394,982,180	326,770,300		68,211,880	
96	Tennessee Valley Authority	0		0	1		184,000	287,862,300	287,862,300		0	
97	Kentucky Utilities Company	D 14		52,855	2		24,540	268,974,708	226,705,696		42,269,012	1,832,3
98	Birmingham Electric Company	1		11,700	0		0	196,012,000	0		196,012,000	187,0
99	Memphis Power & Light Company	1		54,000	0		0	169,072,480	169,072,000		480	199,1
100	Mississippi Power & Light Company	41		19,874	0		0	132,668,159	5,684,761		126,983,398	1,263,0
101	Mississippi Power Company	26		25,572	0		0	104,019,804	17,020,044	g	86,999,760	725,5
102	Tennessee Public Service Company	1		6,125	1		150	90,238,272	417,240		89,821,032	563,6
	Totals for section	116		555,847	25		820,433	3,819,926,875	2,914,806,704		905,120,171	
	West South Central States											
103	Louisiana Power & Light Company	15		90,122	0		0	530,645,000	456,862,000		73,783,000	1,225,0
104	Texas Power & Light Company	14	L	99,211	4		885	482,671,000	462,731,000		19,940,000	1,969,0
105	Houston Lighting & Power Company	6		187,561	0		0	442,468,000	415,188,000		27,280,000	3,718,0
106	Oklahoma Gas & Electric Company	16		184,200	0		0	429,121,897	403,895,099		25,226,798	1,234,7
107	Texas Electric Service Company	13		102,069	0		0	320,440,000	316,806,000		3,634,000	530,0
108	New Orleans Public Service Inc	3		112,700	0		0	296,420,000	296,420,000		0	
109	Arkansas Power & Light Company	28	L	42,314	3	L	68,475	295,801,000	127,238,000		168,563,000	858,0
110	Gulf States Utilities Company	12		77,328	0		0	224,410,809	155,258,349		69,152,460	4,542,3
111	Dallas Power & Light Company	1		82,500	0		0	210,132,192	208,209,900		1,922,292	146,6
112	Southwestern Gas & Electric Company	14		45,700	0		0	207,266,866	125,543,908		81,722,958	692,3
113	West Texas Utilities Company	19		53,678	0		0	199,494,332	195,750,527		3,743,805	900,4
114	Central Power & Light Company	58		59,952	11		15,000	197,389,553	168,338,390		29,051,163	7,690,4
115	Public Service Company of Oklahoma	8		75,000	0		0	189,363,937	159,991,790		29,372,147	530,3
116	San Antonio Public Service Company	3		98.200	3		1,550	165,681,499	124,073,310		41,608,189	
117	El Paso Electric Company	4		56,364	0		0	85,026,898	85,026,898		0	757,4
	Totals for section	214		1,366,899	21		85,910	4,276,332,983	3,701,333,171		574,999,812	
	Mountain States											
118	The Montana Power Company	2		900	11		293,400	889,321,000	887,797,000		1,524,000	2,448,0
119	Utah Power & Light Company	6	L	42,740	35	L	182,117	476,411,537	257,187,073		219,224,464	6,940,3
120	Idaho Power Company	0		0	8		71,500	402,651,686	376,999,629		25,652,057	17,493,2
121	Public Service Company of Colorado	H 13	L	89,355	10	L	37,250	285,823,418	282,962,401		2,861,017	2,178,8
122	Salt River Valley Water Users' Association	0		0	8		70,050	218,534,735	218,534,735		0	5,605,2
	Totals for section	21		132,995	72		654,317	2,272,742,376	2,023,480,838		249,261,538	
	Pacific States											

04,266	40,607,936	30,800,670	137,127,673	18,628,613	.....	56,678,502	154,321,593	5,141,566	85,394,560	4,329	92,027	17,488
29,624	59,467,822	46,900,347	183,267,806	20,476,608	.....	40,361,380	4,698,233	8,388,630	91,965,716	3,480	149,091	26,515
11,742	25,437,779	23,826,306	55,424,372	4,484,016	.....	10,486,655	274,186,260	1,944,856	42,572,440	4,007	49,612	8,279
62,430	40,126,316	39,896,605	194,529,084	10,559,330	.....	43,298,252	23,769,118	2,595,225	55,975,141	2,463	77,542	10,369
71,506	36,899,590	32,787,169	219,489,672	6,532,458	.....	.....	55,905,341	4,150,785	50,071,288	3,526	61,667	10,651
98,829	27,292,064	17,394,255	181,330,541	12,811,539	.....	25,527,654	62,319,720	8,670,819	66,450,583	3,310	58,057	10,436
79,424	42,076,059	43,437,824	86,274,073	17,473,202	.....	.....	35,973,995	12,303,439	60,342,884	6,700	103,431	27,113
94,759	42,603,943	73,762,051	112,896,086	17,477,541	.....	.....	700,320	1,305,587	40,748,142	11,783	80,463	11,281
73,797	46,170,412	35,051,309	73,116,741	1,943,839	468,878	26,223,720	55,016,505	1,405,867	21,887,892	1,017	81,767	9,300
61,367	23,034,041	20,142,125	110,872,804	7,584,142	.....	3,696,570	44,868,972	2,253,117	39,129,459	6,284	51,129	11,221
14,973	28,766,281	16,807,793	32,435,047	9,883,237	.....	2,099,156	107,779,180	4,712,156	44,261,317	8,902	65,910	12,651
39,610	26,402,132	50,866,382	103,966,213	5,070,503	.....	2,300,300	32,904,796	894,278	24,780,766	1,521	43,610	10,481
0	0	1,343,969	16,278,000	76,068,135	0	76,391,440	0	.....	12,962,041	0	0	13
.....	25,132,275	17,956,164	52,153,933	31,852,894	.....	0	7,793,284	.....	22,344,750	.....	40,890	6,088
49,126	13,773,151	9,921,633	60,614,230	4,354,250	.....	535,440	16,438,861	2,121,718	29,420,007	2,748	36,270	7,548
02,271	14,325,592	17,495,134	73,135,268	4,126,133	.....	831,000	1,559,330	891,852	16,015,964	1,765	28,353	4,659
34,697	7,699,673	11,752,993	53,478,723	2,162,712	.....	19,420,144	18,028,201	522,250	11,945,007	3,482	15,588	2,950
0	0	0	0	0	111,840	12,606,130	98,737,434	4,752	2,894,000	0	0	0
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	192,718,242	220,416,760	558,307,493	31,768,408	.....	145,084,433	294,777,795	7,422,979	246,108,817	.....	276,880	39,704
91,214	166,399,656	145,004,824	327,229,430	29,038,282	45,303,765	2,089,500	59,872,494	9,672,780	175,426,488	4,644	288,817	47,681
55,710	74,822,172	120,037,906	169,387,458	32,863,520	.....	96,842,708	25,988,310	6,478,541	68,411,755	2,626	113,530	23,617
75,800	37,512,000	58,503,300	113,518,200	7,148,100	.....	26,694,600	42,924,400	.....	27,326,100	972	55,647	8,118
14,123	22,183,925	28,917,886	145,623,738	2,876,778	.....	13,725,579	42,565,315	1,509,095	48,660,110	887	34,904	6,456
04,747	29,191,192	35,372,827	107,573,295	2,388,002	.....	3,776,699	9,581,053	744,798	34,709,787	1,731	50,018	7,762
67,357	7,130,461	8,297,774	68,888,303	1,715,766	.....	2,098,750	53,957,642	639,448	35,871,368	1,107	17,002	4,950
76,838	25,262,355	9,735,576	73,245,858	8,848,826	.....	.....	33,069,900	1,259,862	26,168,061	1,335	41,561	5,862
62,264	25,303,410	19,639,398	50,543,405	11,759,706	x 2,687,735	3,473,781	7,298,486	2,924,576	26,809,855	3,626	57,703	12,097
18,130	13,537,188	11,812,615	28,290,408	6,935,821	.....	1,459,478	57,347,618	1,521,155	17,177,015	904	26,363	4,914
42,574	23,329,458	27,630,392	14,989,273	9,998,933	.....	.....	21,719,566	295,862	27,725,051	3,660	55,505	18,368
16,313	26,067,385	4,201,203	51,641,537	2,195,491	.....	5,453,731	16,634,049	1,905,296	16,259,813	2,198	42,443	1,574
17,202	14,440,730	9,829,819	47,098,399	8,030,748	.....	334,700	8,955,180	2,969,662	21,557,890	932	27,970	6,629
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
y	y	y	1,462,480,929	y	y	y	y	42,350,326	260,905,877	y	y	y
074,370	61,142,766	77,116,603	903,089,168	6,233,963	3,652,928	21,875,831	112,209,314	5,082,808	143,100,175	1,964	104,889	23,981
.....	87,417,480	130,652,913	645,441,085	14,511,372	.....	47,411,429	51,493,235	A 8,709,246	266,556,519	.....	114,322	34,502
899,928	31,870,796	23,907,161	281,618,312	B 32,011,726	0	2,820,130	B 434,659,776	1,247,550	157,292,943	1,393	48,996	13,160
.....	150,729,350	90,045,181	404,170,371	18,983,830	.....	129,020,756	7,311,200	11,242,507	86,171,833	.....	214,409	26,332
855,827	113,293,850	138,443,426	117,612,688	23,849,103	.....	65,769,633	685,100	5,539,260	93,883,979	913	132,966	19,071
583,196	68,905,199	85,528,377	214,645,762	2,966,607	6,953,427	28,132,714	25,010,756	5,682,216	65,304,540	2,058	94,650	18,118
.....	6,491,177	6,339,884	94,167,841	2,911,198	.....	893,450	318,380,270	3,783,756	30,063,803	.....	11,757	3,154
932,208	39,175,835	24,094,858	74,728,971	4,520,936	.....	6,769,186	13,246,380	A 5,991,492	40,554,728	7,967	51,906	11,396
296,450	44,917,330	40,392,000	26,389,650	15,915,830	0	3,224,500	64,080	A 11,516,450	45,468,710	1,007	63,621	14,099
974,586	12,782,740	13,277,933	82,471,274	2,863,058	.....	6,052,210	3,449,600	A 2,198,103	19,483,542	870	27,150	5,489
.....	17,177,674	11,532,715	59,079,397	2,143,060	.....	11,254,307	6,776,712	1,138,516	10,949,831	.....	29,301	5,768
822,041	10,102,712	10,820,653	53,423,793	1,911,239	.....	2,257,941	2,940,063	604,324	19,022,224	399	15,133	4,994
531,354	10,837,499	9,166,973	14,499,246	1,699,906	.....	.....	34,432,034	1,176,972	22,782,868	603	20,441	5,332
817,268	13,872,572	20,750,593	37,006,884	989,443	59,996	2,475,476	.....	806,970	15,760,671	185	24,017	4,826
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
809,451	49,550,742	54,820,235	714,147,613	6,272,888	.....	5,190,346	536,534,804	A 3,977,064	220,746,362	10,114	66,562	22,187
.....	52,734,573	55,510,613	266,677,888	3,503,152	.....	26,571,802	11,873,800	5,980,668	152,194,971	.....	87,278	20,601
.....	42,839,236	39,771,406	106,868,167	21,672,354	.....	38,942,693	103,363,820	2,573,680	38,950,824	.....	76,509	11,100
0	0	0	0	0	0	0	279,997,885	6,025,615	1,838,800	0	0	0
832,316	16,782,741	15,092,823	86,652,983	5,727,664	.....	.....	103,145,057	4,913,668	34,827,456	3,344	40,056	10,628
187,000	21,760,000	33,750,000	74,084,000	4,657,000	.....	33,270,000	.....	1,121,000	27,183,000	31	48,448	7,058
199,169	22,114,289	40,843,724	34,369,150	8,251,708	.....	24,389,943	10,499,120	1,191,184	27,214,193	354	37,720	9,212
263,063	14,064,979	15,839,138	52,601,035	14,383,288	.....	1,002,598	249,910	2,227,284	31,036,864	859	27,292	8,430
725,520	14,072,520	22,564,555	40,628,183	2,302,673	.....	582,186	1,855,300	635,412	20,653,455	1,027	26,033	10,390
663,602	11,409,604	13,104,916	43,269,266	3,236,622	.....	6,340,666	1,222,930	1,036,615	10,054,051	459	20,618	3,325
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
225,000	8,534,000	6,982,000	178,392,000	3,894,000	.....	.....	295,993,000	1,330,000	34,295,000	1,244	18,771	4,808
969,000	39,637,000	40,829,000	182,848,000	24,901,000	.....	16,466,000	86,808,000	2,158,000	87,055,000	1,522	77,746	20,954
718,000	47,011,000	81,548,000	190,389,000	31,208,000	.....	22,302,000	10,055,000	2,020,000	54,217,000	327	82,434	14,449
234,759	50,476,993	49,738,945	205,239,543	23,161,298	.....	14,868,239	12,566,712	2,441,711	69,393,697	1,058	96,636	22,821
530,000	32,574,000	43,610,000	140,927,000	19,068,000	.....	10,837,000	12,053,000	.....	60,841,000	424	58,433	10,766
.....	31,354,205	E	E 139,748,728	E	F 2,053,000	38,440,800	52,696,900	2,100,582	30,025,785	.....	69,064	12,464
858,000	21,093,000	23,623,000	121,174,000	9,050,000	.....	7,734,000	45,685,000	6,674,000	59,910,000	789	41,261	12,246
542,349	18,813,464	20,828,633	115,430,024	652,177	3,601,557	1,767,100	15,737,618	7,443,976	35,593,911	320	32,659	7,900
146,669	35,340,621	68,909,586	27,608,813	24,225,647	.....	27,738,200	1,903,748	2,939,263	21,319,645	53	57,535	8,181
592,379	19,734,685	23,171,881	102,538,157	6,852,430	.....	6,774,034	13,676,650	5,747,278	28,079,372	1,049	41,340	10,302
900,447	18,198,692	17,080,673	47,255,056	5,673,635	.....	31,352	61,566,170	8,687,240	40,101,067	877	30,638	11,092
590,485	19,907,297	26,063,505	54,287,832	5,542,906	.....	.....	8,296,695	25,524,161	50,076,672	1,438	34,799	13,236
530,378	27,102,646	14,214,744	92,123,249	6,865,946	.....	2,577,484	12,923,530	1,698,038	31,327,922	700	45,676	9,404
.....	24,043,244	56,440,677	32,931,216	1,430,607	.....	1,220,001	18,112,091	672,933	30,830,730	.....	50,569	10,275
757,476	9,296,584	18,337,247	28,311,686	877,449	.....	.....	8,259,738	5,647,560	13,539,158	452	15,739	3,226
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
848,020	35,146,354	34,910,520	580,616,429	7,854,981	G 20,295,447	57,426,399	2,941,480	.....	147,681,370	1,867	51,786	10,689
940,391	50,913,292	d	d 269,105,540	7,502,466	.....	36,101,551	5,840,587	3,628,184	96,379,526	10,905	70,822	d
493,281	28,602,035	21,722,983	42,562,908	8,526,806	F 212,801,703	.....	4,902,220	3,090,949	62,948,801	8,838	25,142	4,473
178,855	45,463,975	41,747,874	109,156,827	9,209,443	.....	98,248	20,291,193	3,338,453	54,338,550	2,667	97,425	15,866
605,227	0	0	0	0	59,990,044	0	75,457,417	43,161,962	34,320,085	4,231	0	0
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

	4,290	530,805,379	448,333,932	82,471,447	2,104,266	40,607,936	30,800,670	137,127,673	18,628,613		56,678,502		154,321,
	3,590	458,656,166	97,433,445	361,222,721	3,129,624	59,467,822	46,900,347	183,267,806	20,476,608		40,361,380		4,698,
	22,244	441,374,426	124,413,258	316,961,168	3,011,742	25,437,779	23,826,306	55,424,372	4,484,016		10,486,655		274,186,
	6,860	412,111,501	221,313,615	190,797,886	1,362,430	40,126,316	39,896,605	194,529,084	10,559,330		43,298,252		23,769,
	0	408,607,809	306,566,450	102,041,359	2,771,506	36,899,590	32,787,169	219,489,672	6,532,458				55,905,
L	17,145	403,796,004	326,366,388	77,429,616	1,998,829	27,292,064	17,394,255	181,330,541	12,811,539		25,527,654		62,319,
	0	302,560,900	146,346,085	g 156,214,815	4,679,424	42,076,059	43,437,824	86,274,073	17,473,202				35,973,
	0	297,288,429	240,911,081	56,377,348	7,794,759	42,603,943	73,762,051	112,896,086	17,477,541				700,
	0	261,858,960	261,836,100	22,860	573,797	46,170,412	35,051,309	73,116,741	1,943,839	468,878	26,223,720		55,016,
	45,230	255,942,597	234,989,557	20,953,040	4,361,367	23,034,041	20,142,125	110,872,804	7,584,142		3,696,570		44,868,
	37,423	252,759,140	206,398,670	46,360,470	6,014,973	28,766,281	16,807,793	32,435,047	9,883,237		2,099,156		107,779,
	0	248,224,980	247,954,780	270,200	1,039,610	26,402,132	50,866,382	103,966,213	5,070,503		2,300,300		32,904,
	0	183,043,585	166,395 000	16,648,585	0	0	1,343,969	16,278,000	76,068,135	0	76,391,440		
	0	157,233,300	157,233,300	0		25,132,275	17,956,164	52,153,933	31,852,894		0		7,793,
	384	138,628,416	1,110,383	137,518,033	1,449,126	13,773,151	9,921,633	60,614,230	4,354,250		535,440		16,438,
	0	130,082,544	5,824,732	124,257,812	1,702,271	14,325,592	17,495,134	73,135,268	4,126,133		831,000		1,559,
	0	126,644,400	37,760,300	88,884,100	1,634,697	7,699,673	11,752,993	53,478,723	2,162,712		19,420,144		18,028,
	0	114,354,156	82,608,689	31,745,467	0	0	0	0	0	111,840	12,606,130		98,737,
	309,236	21,352,579,228	16,513,590,010	4,838,989,218									
	264,000	1,696,604,927	1,696,545,926	59,001		192,718,242	220,416,760	558,307,493	31,768,408		145,084,433		294,777,
	146,735	963,928,433	910,684,051	53,244,382	3,891,214	166,399,656	145,004,824	327,229,430	29,038,282	45,303,765	2,089,500		59,872,
	0	596,988,080	594,767,997	2,220,083	2,155,710	74,822,172	120,037,906	169,387,458	32,863,520		96,842,708		25,988,
	0	314,902,500	314,902,500	0	1,275,800	37,512,000	58,503,300	113,518,200	7,148,100		26,694,600		42,924,
	94,911	306,676,549	306,615,949	60,600	614,123	22,183,925	28,917,886	145,623,738	2,876,778		13,725,579		42,565,
	0	225,142,400	224,729,900	412,500	1,804,747	29,191,192	35,372,827	107,573,295	2,388,002		3,776,699		9,581,
	19,720	179,266,869	175,183,010	4,083,859	667,357	7,130,461	8,297,774	68,888,303	1,715,766		2,098,750		53,957,
	800	178,667,276	178,667,276	0	1,076,838	25,262,355	9,735,576	73,245,858	8,848,826				33,069,
	2,025	152,802,616	140,107,353	12,695,263	2,362,264	25,303,410	19,639,398	50,543,405	11,759,706	x 2,687,735	3,473,781		7,298,
	0	139,099,428	133,605,968	5,493,460	1,018,130	13,537,188	11,812,615	28,290,408	6,935,821		1,459,478		57,347,
	6,545	128,431,109	93,086,233	35,344,876	2,742,574	23,329,458	27,630,392	14,989,273	9,998,933				21,719,
	1,460	126,074,818	125,647,688	427,130	1,716,313	26,067,385	4,201,203	51,641,537	2,195,491		5,453,731		16,634,
	3,895	114,234,330	103,112,212	11,122,118	1,017,202	14,440,730	9,829,819	47,098,399	8,030,748		334,700		8,955,
	540,091	5,122,819,335	4,997,656,063	125,163,272									
L	598,730	1,765,737,132	1,405,454,505	360,282,627	y	y	y	1,462,480,929	y	y	y		y
	44,900	1,335,577,926	989,068,231	346,509,695	2,074,370	61,142,766	77,116,603	903,089,168	6,233,963	3,652,928	21,875,831		112,209,
L	290,187	1,252,193,279	1,022,353,205	g 229,840,074		87,417,480	130,652,913	645,441,085	14,511,372		47,411,429		51,493,
	205,450	966,328,322	570,515,722	395,812,600	899,928	31,870,796	23,907,161	281,618,312	B 32,011,726	0	2,820,130		B 434,659,
	0	897,675,028	83,835,430	813,839,598		150,729,350	90,045,181	404,170,371	18,983,830		129,020,756		7,311,
	0	562,432,866	425,272,266	137,160,600	3,355,827	113,293,850	138,443,426	117,612,688	23,849,103		65,769,633		685,
	28,970	506,712,794	410,392.934	96,319,860	3,583,196	68,905,199	85,528,377	214,645,762	2,966,607	6,953,427	28,132,714		25,010,
	154,705	463.031,379	453,315,446	9,715,933		6,491,177	6,339,884	94,167,841	2,911,198		893,450		318,380,
L	14,426	217,014,594	195,058,695	21,955,899	7,932,208	39,175,835	24,094,858	74,728,971	4,520,936		6,769,186		13,246,
	0	191,185,000	187,279,000	3,906,000	3,296,450	44,917,330	40,392,000	26,389,650	15,915,830	0	3,224,500		64,
	600	143,553,046	136,786,287	6,766,759	974,586	12,782,740	13,277,933	82,471,274	2,863,058		6,052,210		3,449,
	0	120,052,212	0	120,052,212		17,177,674	11,532,715	59,079,397	2,143,060		11,254,307		6,776,
	16,275	101,504,990	101,322,190	g 182,800	422,041	10,102,712	10,820,653	53,423,793	1,911,239		2,257,941		2,940,
	14,040	95,226,852	94,051,572	1,175,280	631,354	10,837,499	9,166,973	14,499,246	1,699,906				34,432,
	0	92,039,873	1,394,300	90,645,573	317,268	13,872,572	20,750,593	37,006,884	989,443	59,996	2,475,476		
	1,368,283	8,710,265,293	6,076,099,783	2,634,165,510									
	398,300	1,601,049,505	1,398,968,896	g 202,080,609	9,809,451	49,550,742	54,820,235	714,147,613	6,272,888		5,190,346		536,534,
	133,123	575,047,467	482,305,467	g 92,742,000		52,734,573	55,510,613	266,677,888	3,503,152		26,571,802		11,873,
	80,320	394,982,180	326,770,300	68,211,880		42,839,236	39,771,406	106,868,167	21,672,354		38,942,693		103,363,
	184,000	287,862,300	287,862,300	0	0	0	0	0	0	0	0		279,997,
	24,540	268,974,708	226,705,696	42,269,012	1,832,316	16,782,741	15,092,823	86,652,983	5,727,664				103,145,
	0	196,012,000	0	196,012,000	187,000	21,760,000	33,750,000	74,084,000	4,657,000		33,270,000		
	0	169,072,480	169,072,000	480	199,169	22,114,289	40,843,724	34,369,150	8,251,708		24,389,943		10,499,
	0	132,668,159	5,684,761	126,983,398	1,263,063	14,064,979	15,839,138	52,601,035	14,383,288		1,002,598		249,
	0	104,019,804	17,020,044	g 86,999,760	725,520	14,072,520	22,564,555	40,628,183	2,302,673		582,186		1,855,
	150	90,238,272	417,240	89,821,032	563,602	11,409,604	13,104,916	43,269,266	3,236,622		6,340,666		1,222,
	820,433	3,819,926,875	2,914,806,704	905,120,171									
	0	530,645,000	456,862,000	73,783,000	1,225,000	8,534,000	6,982,000	178,392,000	3,894,000				295,993,
	885	482,671,000	462,731,000	19,940,000	1,969,000	39,637,000	40,829,000	182,848,000	24,901,000		16,466,000		86,808,
	0	442,468,000	415,188,000	27,280,000	3,718,000	47,011,000	81,548,000	190,389,000	31,208,000		22,302,000		10,055,
	0	429,121,897	403,895,099	25,226,798	1,234,759	50,476,993	49,738,945	205,239,543	23,161,298		14,868,239		12,566,
	0	320,440,000	316,806,000	3,634,000	530,000	32,574,000	43,610,000	140,927,000	19,068,000		10,837,000		12,053,
	0	296,420,000	296,420,000	0		31,354,205	E	E 139,748,728	E	F 2,053,000	38,440,800		52,696,
L	68,475	295,801,000	127,238,000	168,563,000	858,000	21,093,000	23,623,000	121,174,000	9,050,000		7,734,000		45,685,
	0	224,410,809	155,258,349	69,152,460	4,542,349	18,813,464	20,828,633	115,430,024	652,177	3,601,557	1,767,100		15,737,
	0	210,132,192	208,209,900	1,922,292	146,669	35,340,621	68,909,586	27,608,813	24,225,647		27,738,200		1,903,
	0	207,266,866	125,543,908	81,722,958	692,379	19,734,685	23,171,881	102,538,157	6,852,430		6,774,034		13,676,
	0	199,494,332	195,750,527	3,743,805	900,447	18,198,692	17,080,673	47,255,056	5,673,635		31,352		61,566,
	15,000	197,389,553	168,338,390	29,051,163	7,690,485	19,907,297	26,063,505	54,287,832	5,542,906				8,296,
	0	189,363,937	159,991,790	29,372,147	530,378	27,102,646	14,214,744	92,123,249	6,865,946		2,577,484		12,923,
	1,550	165,681,499	124,073,310	41,608,189		24,043,244	56,440,677	32,931,216	1,430,607		1,220,001		18,112,
	0	85,026,898	85,026,898	0	757,476	9,296,584	18,337,247	28,311,686	877,449				8,259,
	85,910	4,276,332,983	3,701,333,171	574,999,812									
	293,400	889,321,000	887,797,000	1,524,000	2,448,020	35,146,354	34,910,520	580,616,429	7,854,981	G 20,295,447	57,426,399		2,941,
L	182,117	476,411,537	257,187,073	219,224,464	6,940,391	50,913,292	d	d 269,105,540	7,502,466		36,101,551		5,840,
	71,500	402,651,686	376,999,629	25,652,057	17,493,281	28,602,035	21,722,983	42,562,908	8,526,806	F 212,801,703			4,902,
L	37,250	285,823,418	282,962,401	2,861,017	2,178,855	45,463,975	41,747,874	109,156,827	9,209,443		98,248		20,291,
	70,050	218,534,735	218,534,735	0	5,605,227	0	0	0	0	59,990,044	0		75,457,
	654,317	2,272,742,376	2,023,480,838	249,261,538									
Totals for section					116	555,847	25	820,433	3,819,926,875	2,914,806,704	905,120,171		

West South Central States

321,593	5,141,566	85,394,560	4,329	92,027	17,488	3,112	1,511			5	48	47
698,233	8,388,630	91,965,716	3,480	149,091	26,515	5,386	1,002				26	48
186,260	1,944,856	42,572,440	4,007	49,612	8,279	330	33			18	12	49
769,118	2,595,225	55,975,141	2,463	77,542	10,369	1,630	24			9	11	50
905,341	4,150,785	50,071,288	3,526	61,667	10,651	254	28				12	51
319,720	8,670,819	66,450,583	3,310	58,057	10,436	2,012	838			3	18	52
973,995	12,303,439	60,342,884	6,700	103,431	27,113	152	1,628				13	53
700,320	1,305,587	40,748,142	11,783	80,463	11,281	217	10				1	54
016,505	1,405,867	21,887,892	1,017	81,767	9,300	661	138			1	5	55
868,972	2,253,117	39,129,459	6,284	51,129	11,221	2,691	181				15	56
779,180	4,712,156	44,261,317	8,902	65,910	12,651	3,502	251				48	57
904,796	894,278	24,780,766	1,521	43,610	10,481	201	33			2	5	58
0		12,962,041	0	0	13	1			0	1	0	59
793,284		22,344,750		40,890	6,088	397				0	147	60
438,861	2,121,718	29,420,007	2,748	36,270	7,548	1,380	669			1	17	61
559,330	891,852	16,015,964	1,765	28,353	4,659	107	20			1	6	62
028,201	522,250	11,945,007	3,482	15,588	2,950	1,126	229			2	7	63
737,434	4,752	2,894,000	0	0	0	0	0		1	3	3	64
777,795	7,422,979	246,108,817		276,880	39,704	338	39			3	20	65
872,494	9,672,780	175,426,488	4,644	288,817	47,681	21,107	329		381	2	62	66
988,310	6,478,541	68,411,755	2,626	113,530	23,617	165	414			3	10	67
924,400		27,326,100	972	55,647	8,118	218	37			1	3	68
565,315	1,509,095	48,660,110	887	34,904	6,456	390	65			1	24	69
581,053	744,798	34,709,787	1,731	50,018	7,762	689	43			8	17	70
957,642	639,448	35,871,368	1,107	17,002	4,950	1,365	50			3	9	71
069,900	1,259,862	26,168,061	1,335	41,561	5,862	2,524	263				2	72
298,486	2,924,576	26,809,855	3,626	57,703	12,097	3,729	291	*x*	1,082	1	29	73
347,618	1,521,155	17,177,015	904	26,363	4,914	751	351				14	74
719,566	295,862	27,725,051	3,660	55,505	18,368	53	486				47	75
634,049	1,905,296	16,259,813	2,198	42,443	1,574	339	84			2	20	76
955,180	2,969,662	21,557,890	932	27,970	6,629	1,976	265				11	77
y	42,350,326	260,905,877	*y*	*y*	*y*	584	*y*	*y*		*y*	*y*	78
209,314	5,082,808	143,100,175	1,964	104,889	23,981	620	141	556		7	28	79
493,235	*A* 8,709,246	266,556,519		114,322	34,502	425	430			1	42	80
659,776	1,247,550	157,292,943	1,393	48,996	13,160	864	*B* 1,075		0		*B* 8	81
311,200	11,242,507	86,171,833		214,409	26,332	330	40			1	2	82
685,100	5,539,260	93,883,979	913	132,966	19,071	143	36			4	1	83
010,756	5,682,216	65,304,540	2,058	94,650	18,118	836	80		439	3	14	84
380,270	3,783,756	30,063,803		11,757	3,154	444	75			1	6	85
246,380	*A* 5,991,492	40,554,728	7,967	51,906	11,396	2,077	109			3	6	86
64,080	*A* 11,516,450	45,468,710	1,007	63,621	14,099	2,803	1,157		0	2	1	87
449,600	*A* 2,198,103	19,483,542	870	27,150	5,489	67	107				2	88
776,712	1,138,516	10,949,831		29,301	5,768	233	21			1	3	89
940,063	604,324	19,022,224	399	15,133	4,994	82	59				3	90
432,034	1,176,972	22,782,868	603	20,441	5,332	194	123				14	91
	806,970	15,760,671	185	24,017	4,826	49	23		42	2		92
534,804	*A* 3,977,064	220,746,362	10,114	66,562	22,187	650	145				51	93
873,800	5,980,668	152,194,971		87,278	20,601	740	90			1	5	94
363,820	2,573,680	38,950,824		76,509	11,100	3,650	359			1	4	95
997,885	6,025,615	1,838,800	0	0	0	0	0		0	0	2	96
145,057	4,913,668	34,827,456	3,344	40,056	10,628	1,918	286				27	97
	1,121,000	27,183,000	31	48,448	7,058	926	281					98
499,120	1,191,184	27,214,193	354	37,720	9,212	194	147			1	4	99
249,910	2,227,284	31,036,864	859	27,292	8,430	804	809				2	100
855,300	635,412	20,653,455	1,027	26,033	10,390	134	115			1	1	101
222,930	1,036,615	10,054,051	459	20,618	3,325	211	210				1	102
993,000	1,330,000	34,295,000	1,244	18,771	4,808	407	325				8	103
808,000	2,158,000	87,055,000	1,522	77,746	20,954	2,117	1,098			2	20	104
055,000	2,020,000	54,217,000	327	82,434	14,449	914	519			2	15	105
566,712	2,441,711	69,393,697	1,058	96,636	22,821	8,605	826			2	26	106
053,000		60,841,000	424	58,433	10,766	988	566			1	15	107
696,900	2,100,582	30,025,785		69,064	12,464	1,081	538	*F*	1	1	7	108
685,000	6,674,000	59,910,000	789	41,261	12,246	731	923			2	9	109
737,618	7,443,976	35,593,911	320	32,659	7,900	352	27		15	1	13	110
803,748	2,939,263	21,319,645	53	57,535	8,181	849	297			1	1	111
676,650	5,747,278	28,079,372	1,049	41,340	10,302	2,414	232			2	6	112
566,170	8,687,240	40,101,067	877	30,638	11,092	1,015	515			1	8	113
296,695	25,524,161	50,076,672	1,438	34,799	13,236	691	297				9	114
923,530	1,698,038	31,327,922	700	45,676	9,404	2,412	420			3	4	115
112,091	672,933	30,830,730		50,569	10,275	231						116
259,738	5,647,560	13,539,158	452	15,739	3,226	199	4				2	117
941,480		147,681,370	1,867	51,786	10,689	210	87		*G*	2	7	118
840,587	3,628,184	96,379,526	10,905	70,822	*d*	*d* 11,355	107			6	15	119
902,220	3,090,949	62,948,801	8,838	25,142	4,473	1,046	579	*F*	3		5	120
291,193	3,338,453	54,338,550	2,667	97,425	15,866	6,315	63			1	13	121
457,417	43,161,962	34,320,085	4,231	0	0	0	0		347	0	9	122

n Includes as credit 19,907,100 kw.-hr. economy flow to other companies.

o Includes company's share of jointly owned plant (Deepwater).

p Net; 1,881,189,000 kw.-hr. total purchased less 35,395,000 kw.-hr. sales for resale outside of Chicago.

q Sold to other public utilities in Chicago. (See also note *p*.)

r Includes 36,817 hall light customers.

s Includes company's share of jointly owned plant (Windsor).

t Includes about 11,000 kw. for station auxiliary use; net 204,000 kw.

u Two of the plants are combination fuel and hydro plants—total 18.

v Includes entire year's operations of Wisconsin Valley Electric Co. and subsidiaries acquired June 5, 1933.

w Includes one plant, 1,100 kw., internal combustion.

x Fuel consumers.

y Company sells at wholesale only including sales to other public utilities for resale. No segregated classification.

z Includes Kentucky & West Virginia Power Co., Inc., and Kingsport Utilities, Inc.

A Includes energy used in gas, water, bus or ice departments, or in combinations of such departments.

B Sales to municipal systems included under municipal service.

C Includes Broad River Power Co. and Lexington Water Power Co.

D Four operating—10 standby.

E Commercial, small light and power (retail) and municipal service (street lighting, etc.) combined with commercial, large light and power (wholesale).

F Interchange.

G Interdepartmental sales.

H Includes 2 plants, 2,280 kw., internal combustion.

I Includes 2,878,791 kw.-hr. interchange received.

J 6,371 customers in apartment houses and energy for these included under commercial small light and power (retail).

K Industrial light and power wholesale and retail.

L Leased plants.

The reported number and rating includes plants (in some cases not segregated as to kind of power) operated under contract or lease as follows:

Co. No.	No. of Plants	Kw.	
2	1	50	(Hydro)
4	1	30,000	
6	2	960	
15	5	49,800	
37	2	.....	(Hydro)
47	1	18,000	(Fuel)
52	2	15,520	(Hydro)
78	5	119,400	
80	6	978	(Fuel)
80	2	3,100	(Hydro)
86	1	7,500	(Hydro)

1		295,400	889,321,000	887,797,000	1,524,000	2,448,000										
5	L	182,117	476,411,537	257,187,073	219,224,464	6,940,391	50,913,292	d	d	269,105,540	7,502,466		36,101,551	5,840		
8		71,500	402,651,686	376,999,629	25,652,057	17,493,281	28,602,035	21,722,983		42,562,908	8,526,806	F	212,801,703	4,902		
0	L	37,250	285,823,418	282,962,401	2,861,017	2,178,855	45,463,975	41,747,874		109,156,827	9,209,443		98,248	20,291		
8		70,050	218,534,735	218,534,735	0	5,605,227	0	0		0	0		59,990,044	0	75,457	
2		654,317	2,272,742,376	2,023,480,838	249,261,538											
	Totals for section		116	555,847	25	820,433	3,819,926,875	2,914,806,704		905,120,171						
	West South Central States															
103	Louisiana Power & Light Company		15	90,122	0	0	530,645,000	456,862,000		73,783,000	1,225,0					
104	Texas Power & Light Company		14	L 99,211	4	885	482,671,000	462,731,000		19,940,000	1,969,0					
105	Houston Lighting & Power Company		6	187,561	0	0	442,468,000	415,188,000		27,280,000	3,718,0					
106	Oklahoma Gas & Electric Company		16	184,200	0	0	429,121,897	403,895,099		25,226,798	1,234,7					
107	Texas Electric Service Company		13	102,069	0	0	320,440,000	316,806,000		3,634,000	530,0					
108	New Orleans Public Service Inc		3	112,700	0	0	296,420,000	296,420,000		0						
109	Arkansas Power & Light Company		28	L 42,314	3	L 68,475	295,801,000	127,238,000		168,563,000	858,0					
110	Gulf States Utilities Company		12	77,328	0	0	224,410,809	155,258,349		69,152,460	4,542,3					
111	Dallas Power & Light Company		1	82,500	0	0	210,132,192	208,209,900		1,922,292	146,6					
112	Southwestern Gas & Electric Company		14	45,700	0	0	207,266,866	125,543,908		81,722,958	692,3					
113	West Texas Utilities Company		19	53,678	0	0	199,494,332	195,750,527		3,743,805	900,4					
114	Central Power & Light Company		58	59,952	11	15,000	197,389,553	168,338,390		29,051,163	7,690,4					
115	Public Service Company of Oklahoma		8	75,000	0	0	189,363,937	159,991,790		29,372,147	530,3					
116	San Antonio Public Service Company		3	98.200	3	1,550	165,681,499	124,073,310		41,608,189						
117	El Paso Electric Company		4	56,364	0	0	85,026,898	85,026,898		0	757,4					
	Totals for section		214	1,366,899	21	85,910	4,276,332,983	3,701,333,171		574,999,812						
	Mountain States															
118	The Montana Power Company		2	900	11	293,400	889,321,000	887,797,000		1,524,000	2,448,0					
119	Utah Power & Light Company		6	L 42,740	35	L 182,117	476,411,537	257,187,073		219,224,464	6,940,3					
120	Idaho Power Company		0	0	8	71,500	402,651,686	376,999,629		25,652,057	17,493,2					
121	Public Service Company of Colorado	H	13	L 89,355	10	L 37,250	285,823,418	282,962,401		2,861,017	2,178,8					
122	Salt River Valley Water Users' Association		0	0	8	70,050	218,534,735	218,534,735		0	5,605,2					
	Totals for section		21	132,995	72	654,317	2,272,742,376	2,023,480,838		249,261,538						
	Pacific States															
123	Pacific Gas & Electric Company		13	L 378,800	50	L 877,144	4,048,123,590	3,101,236,879		946,886,711	541,409,2					
124	Southern California Edison Company Ltd		5	L 461,600	23	L 488,340	2,772,640,491	2,760,493,670	I	12,146,821	377,834,7					
125	Puget Sound Power & Light Company		4	L 105,000	15	L 216,175	788,481,852	744,017,181		44,464,671	36,048,2					
126	City of Los Angeles, Bureau of Power & Light		0	0	5	110,605	712,102,112	295,879,700		416,222,412						
127	The Washington Water Power Company		1	150	12	203,534	634,984,182	622,875,340		12,108,842	18,711,0					
128	Portland General Electric Company		3	75,500	6	93,980	496,188,200	494,033,100		2,155,100						
129	The California Oregon Power Company		3	L 15,410	12	100,080	478,306,895	466,922,655		11,384,240						
130	Hetch Hetchy Water Supply (San Francisco)		0	0	2	83,300	469,418,170	469,417,170		1,000						
131	Los Angeles Gas & Electric Corporation		2	148,700	0	0	356,207,095	360,083,132	F	—3,876,037						
132	City of Seattle, Light & Power Dept		1	30,000	2	97,500	321,750,000	321,513,000		237,000						
133	The Nevada-California Electric Corporation System (N)		3	8,157	11	58,575	300,679,349	O 245,414,012	P	55,265,337	40,765,8					
134	Northwestern Electric Company		2	42,500	1	9,600	266,943,824	109,134,191		157,809,633	2,101,7					
135	City of Tacoma, Dept. of Public Utilities		2	34,000	3	114,000	229,619,600	229,401,600		218,000						
136	San Diego Consolidated Gas & Electric Company		2	74,000	0	0	178,032,900	174,098,230		3,934,670						
137	Pacific Power & Light Company		1	8,000	9	L 22,567	173,930,919	125,214,688		48,716,231	15,441,0					
	Totals for section		42	1,381,817	151	2,475,400	12,227,409,179	10,519,734,548		1,707,674,631						
	Canada															
138	Hydro-Electric Power Commission of Ontario		1	20,000	39	971,200	4,990,727,444	3,103,510,004		1,887,217,440						
139	The Shawinigan Water & Power Company		0	0	7	496,650	3,842,872,196	2,814,556,600		1,028,315,596	1,642,0					
140	Canadian Hydro-Electric Corporation, Ltd. System		1	6,750	18	486,245	2,689,161,650	2,687,383,598		1,778,052						
141	Duke-Price Power Company, Ltd		0	0	1	330,000	1,724,566,120	1,724,566,120		0						
142	Montreal Light, Heat & Power Consolidated		1	16,500	4	215,410	1,529,382,839	631,028,720		898,354,119						
143	West Kootenay Power & Light Company, Ltd		0	0	5	169,825	660,905,059	660,905,059		0	375,7					
144	City of Winnipeg Hydro-Electric System	T	1	T 11,190	2	L 96,234	508,256,900	398,289,900		109,967,000						
145	Winnipeg Electric Company (W)		1	12,000	3	251,028	487,213,500	487,213,500		0						
146	Canada Northern Power Corporation, Ltd		0	0	9	94,375	474,553,410	474,553,410		0						
147	Alcoa Power Company, Ltd		0	0	1	150,000	455,089,497	455,089,497		0						
148	Canadian Niagara Power Company, Ltd		0	0	1	75,000	428,956,100	428,956,100								
149	Beauharnois Light, Heat & Power Company		0	0	1	182,000	421,100,000	421,100,000		0						
150	British Columbia Electric Railway Company, Ltd. (Y)		1	17,500	5	167,325	389,102,000	389,102,000		0						
151	Abitibi Electric Development Company, Ltd		0	0	1	Z 48,000	227,324,308	227,324,308		0						
152	The Nova Scotia Power Commission		0	0	13	Z 62,955	199,952,617	199,952,617		0						
153	Southern Canada Power Company, Ltd		0	0	5	43,875	185,252,237	157,973,070		27,279,167	645,0					
154	Great Lakes Power Company, Ltd		0	0	2	38,200	173,949,572	173,949,572		0	61,3					
155	Ottawa Valley Power Company		0	0	1	80,000	141,535,800	141,535,800		0						
156	Montreal Island Power Company		0	0	1	45,000	135,786,020	135,786,020		0						
157	Calgary Power Company, Ltd		4	L 14,090	3	53,000	134,886,292	131,983,470	*	2,902,822	209,2					
	Totals for Canada		10	98,030	122	4,019,337	19,800,573,561	15,844,759,365		3,955,814,196						
	Mexico															
158	The Mexican Light & Power Company, Ltd. and Subsidiaries		2	32,240	14	179,498	725,351,101	725,351,101		0	943,2					
	Electric Railways and Electrified Railroads															
159	Interborough Rapid Transit Company		2	390,000	0	0	1,147,920,881	1,143,131,780		4,789,101						
160	Williamsburgh Power Plant Corporation (B. M. T.)		2	204,100	0	0	608,619,727	608,619,727		0						
161	Chicago Surface Lines		0	0	0	0	594,098,027	0		594,098,027						
162	Philadelphia Rapid Transit Company		0	0	0	0	287,666,276	0		287,666,276						
163	The Pennsylvania Railroad (Long Island City Gen. Station)		1	88,000	0	0	284,602,140	201,826,640		82,775,500						
164	Boston Elevated Railway		2	180,000	0	0	220,340,490	220,340,490		0						
165	The New York Central Railroad Company		2	110,000	0	0	212,161,952	157,697,952		54,464,000						
166	The New York, New Haven & Hartford Railroad Company		1	47,200	0	0	154,300,000	79,700,000		74,600,000						
167	St. Louis Public Service Company	‡	1	‡ 12,000	0	0	141,511,652	6,005,852		135,505,800						
168	Pacific Electric Railway Company		0	0	0	0	133,094,054	0		133,094,054						
169	Twin City Rapid Transit Company		1	75,000	2	L 16,000	115,356,150	90,526,700		24,829,450						
170	Norfolk & Western Railway Company		6	43,855	0	0	103,837,503	78,346,884		25,490,619						
171	The Connecticut Company		1	22,500	0	0	75,368,837	32,609,910		42,758,927						
172	Chicago, Milwaukee, St. Paul & Pacific Railroad Company		0	0	0	0	70,525,944	0		70,525,944						
	Totals for Railways and Railroads		19	1,172,655	2	16,000	4,149,403,633	2,618,805,935		1,530,597,698						

4,902,220	3,090,949	62,948,801	8,838	25,142	4,473	1,046	579	F 3	.....	5	120	47	1	10,000 (Fuel)
0,291,193	3,338,453	54,338,550	2,667	97,425	15,866	6,315	63	.....	1	13	121	52	2	15,520 (Hydro)
5,457,417	43,161,962	34,320,085	4,231	0	0	0	0	347	0	9	122	78	5	119,400
												80	6	978 (Fuel)
												80	2	3,100 (Hydro)
												86	1	7,500 (Hydro)

225,000	8,534,000	6,982,000	178,392,000	3,894,000	.....	.....	295,993,000	1,330,000	34,295,000	1,244	18,771	4,80
969,000	39,637,000	40,829,000	182,848,000	24,901,000	.....	16,466,000	86,808,000	2,158,000	87,055,000	1,522	77,746	20,95
718,000	47,011,000	81,548,000	190,389,000	31,208,000	.....	22,302,000	10,055,000	2,020,000	54,217,000	327	82,434	14,44
234,759	50,476,993	49,738,945	205,239,543	23,161,298	.....	14,868,239	12,566,712	2,441,711	69,393,697	1,058	96,636	22,82
530,000	32,574,000	43,610,000	140,927,000	19,068,000	.....	10,837,000	12,053,000	.....	60,841,000	424	58,433	10,76
.....	31,354,205	*E*	*E* 139,748,728	*E*	F 2,053,000	38,440,800	52,696,900	2,100,582	30,025,785	.....	69,064	12,46
858,000	21,093,000	23,623,000	121,174,000	9,050,000	.....	7,734,000	45,685,000	6,674,000	59,910,000	789	41,261	12,24
542,349	18,813,464	20,828,633	115,430,024	652,177	3,601,557	1,767,100	15,737,618	7,443,976	35,593,911	320	32,659	7,90
146,669	35,340,621	68,909,586	27,608,813	24,225,647	.....	27,738,200	1,903,748	2,939,263	21,319,645	53	57,535	8,18
692,379	19,734,685	23,171,881	102,538,157	6,852,430	.....	6,774,034	13,676,650	5,747,278	28,079,372	1,049	41,340	10,30
900,447	18,198,692	17,080,673	47,255,056	5,673,635	.....	31,352	61,566,170	8,687,240	40,101,067	877	30,638	11,09
690,485	19,907,297	26,063,505	54,287,832	5,542,906	.....	.....	8,296,695	25,524,161	50,076,672	1,438	34,799	13,23
530,378	27,102,646	14,214,744	92,123,249	6,865,946	.....	2,577,484	12,923,530	1,698,038	31,327,922	700	45,676	9,40
.....	24,043,244	56,440,677	32,931,216	1,430,607	.....	1,220,001	18,112,091	672,933	30,830,730	.....	50,569	10,27
757,476	9,296,584	18,337,247	28,311,686	877,449	.....	.....	8,259,738	5,647,560	13,539,158	452	15,739	3,22
448,020	35,146,354	34,910,520	580,616,429	7,854,981	G 20,295,447	57,426,399	2,941,480	.....	147,681,370	1,867	51,786	10,68
940,391	50,913,292	*d*	*d* 269,105,540	7,502,466	.....	36,101,551	5,840,587	3,628,184	96,379,526	10,905	70,822	*d*
493,281	28,602,035	21,722,983	42,562,908	8,526,806	F 212,801,703	.....	4,902,220	3,090,949	62,948,801	8,838	25,142	4,47
178,855	45,463,975	41,747,874	109,156,827	9,209,443	.....	98,248	20,291,193	3,338,453	54,338,550	2,667	97,425	15,86
605,227	0	0	0	0	59,990,044	0	75,457,417	43,161,962	34,320,085	4,231	0	
409,226	430,293,098	288,152,453	1,218,912,524	52,917,924	0	256,433,173	157,694,423	67,052,346	1,035,258,423	34,480	580,429	85,75
834,785	252,518,794	170,334,982	662,844,103	35,370,355	F 1,291,300	227,809,774	501,477,446	4,612,411	538,546,541	14,516	396,062	49,82
048,254	115,254,618	156,597,830	204,320,305	4,548,830	.....	53,309,662	21,318,372	6,438,939	190,645,042	23,937	114,664	20,99
.....	106,920,947	280,322,482	165,684,443	57,448,737	.....	.....	.....	4,956,483	96,769,020	.....	214,728	51,53
711,005	78,355,500	61,381,252	258,373,746	5,721,518	.....	39,149,961	46,994,978	10,015,966	116,280,256	4,724	48,963	8,79
.....	87,458,469	*J* 84,193,373	*K* 137,238,918	24,559,175	.....	54,569,213	8,723,984	3,690,689	95,754,379	.....	*J* 89,292	*J* 17,91
.....	32,186,535	11,105,133	45,618,965	2,129,760	.....	.....	303,556,255	3,355,929	80,354,318	.....	19,372	4,11
0	0	0	0	0	0	0	420,724,800	20,305,298	28,388,072	0	0	
0	*M* 178,239,778	*M* 93,921,372	.....	4,239,633	.....	.....	29,415,520	5,470,726	44,920,066	0	*M* 145,253	*M* 9,74
.....	80,576,858	108,361,180	0	18,296,688	.....	.....	32,523,824	9,984,633	72,006,817	.....	80,884	12,84
765,847	16,781,540	26,492,487	104,839,326	810,524	.....	.....	14,818,328	9,284,512	86,886,785	1,328	21,241	7,34
101,175	35,190,100	60,881,245	123,608,914	2,318,155	.....	.....	2,659,211	3,455,196	36,729,828	3,694	30,502	5,72
.....	38,774,841	23,903,928	101,568,098	8,909,902	5,146,594	980,669	5,429,175	9,680,689	35,225,704	.....	*Q* 32,629	3,83
.....	66,134,448	54,925,040	.....	5,711,991	.....	12,773,000	8,424,973	2,910,826	27,152,622	.....	70,233	4,78
441,612	39,762,226	65,519,476	.....	2,658,912	.....	1,693,480	2,731,048	4,360,927	41,763,238	8,070	33,136	7,77
642,608	22,404,179	17,922,852	2,906,936,424	4,049,288	.....	.....	537,238,985	18,351,488	334,326,372	6,222	40,180	10,98
.....	17,008,302	5,497,288	1,399,729,560	1,151,050	.....	3,472,880	1,185,353,738	.....	76,948,832	.....	20,381	26
0	0	0	1,150,482,777	0	0	0	574,083,343	.....	.....	0	0	
.....	121,691,089	166,306,856	588,608,231	18,224,451	*S* 286,163,739	119,717,889	23,504,320	.....	205,166,264	.....	220,015	51,66
375,351	2,605,296	1,244,494	589,971,174	383,840	.....	.....	4,443,606	3,464,269	58,417,029	83	2,976	51
.....	179,153,416	74,274,466	44,403,745	14,780,365	*U* 130,541,300	.....	501,720	.....	64,601,888	.....	40,556	6,03
.....	76,359,362	16,127,446	71,232,677	127,514,250	59,666,788	36,566,850	24,640,441	*X*	75,105,686	.....	.....	
.....	11,117,122	4,969,598	409,759,699	766,134	.....	485,516	.....	.....	47,455,341	.....	10,850	2,62
.....	432,897	.....	389,306,334	.....	.....	.....	.....	.....	65,350,266	.....	13	
0	0	0	33,898,165	0	0	0	370,260,000	16,823,535	118,300	0	0	
.....	71,590,428	50,203,426	135,102,330	11,399,956	.....	75,118,899	6,071,513	7,435,125	32,180,323	.....	80,628	13,89
.....	.....	.....	29,464,000	1,806,000	.....	.....	.....	196,054,308	.....	.....	.....	
.....	283,755	239,320	144,169,310	24,000	.....	.....	45,239,985	801,967	9,194,280	.....	848	
645,000	11,590,800	15,060,000	86,828,940	3,120,200	.....	0	57,818,200	.....	10,189,097	1,280	17,515	4,77
61,253	85,230	46,681	155,349,635	41,701	.....	1,145,118	14,359,200	278,560	2,582,194	85	195	8
0	0	0	0	0	0	0	139,417,890	2,117,910	.....	0	0	
0	0	0	0	0	0	0	135,786,020	0	0	0	0	
209,318	2,726,866	4,926,394	3,861,590	1,168,177	.....	.....	101,156,525	323,800	20,513,622	278	6,994	4,58
943,478	20,239,557	45,872,488	278,540,759	49,769,250	† 22,409,486	81,495,699	.....	7,561,278	218,519,106	95	123,575	46,98

Summary of Generator Rating and Output

Section	Number of Companies or Systems	Number of Generating Plants and Generator Ratings — All Plants — No.	All Plants — Rating Kw.	Fuel Plants — No.	Fuel Plants — Rating Kw.	Hydro Plants — No.	Hydro Plants — Rating Kw.	Energy Generated (Net), Kw.-Hr.	Ene Purch Kw.
United States	**137**	**1,863**	**30,473,841**	**960**	**21,699,398**	**903**	**8,774,443**	**73,818,036,915**	**15,504,8**
New England	14	169	2,293,703	44	1,579,912	125	713,791	4,920,826,592	1,474,6
Middle Atlantic	21	339	8,632,675	143	6,825,693	196	1,806,982	22,150,509,206	2,994,7
East North Central	29	276	6,718,368	144	6,409,132	132	309,236	16,513,590,010	4,838,9
West North Central	13	180	2,219,030	112	1,678,939	68	540,091	4,997,656,063	125,1
South Atlantic	15	237	3,136,447	124	1,768,164	113	1,368,283	6,076,099,783	2,634,1
East South Central	10	141	1,376,280	116	555,847	25	820,433	2,914,806,704	905,1
West South Central	15	235	1,452,809	214	1,366,899	21	85,910	3,701,333,171	574,9
Mountain	5	93	787,312	21	132,995	72	654,317	2,023,480,838	249,2
Pacific	15	193	3,857,217	42	1,381,817	151	2,475,400	10,519,734,548	1,707,6
Canada	**20**	**132**	**4,117,367**	**10**	**98,030**	**122**	**4,019,337**	**15,844,759,365**	**3,955,8**
Mexico	**1**	**16**	**211,738**	**2**	**32,240**	**14**	**179,498**	**725,351,101**	
Railways and Railroads	**14**	**21**	**1,188,655**	**19**	**1,172,655**	**2**	**16,000**	**2,618,805,935**	**1,530,5**

5	820,433	3,819,926,875	2,914,806,704	905,120,171									
0	0	530,645,000	456,862,000	73,783,000	1,225,000	8,534,000	6,982,000	178,392,000	3,894,000				295,993,
4	885	482,671,000	462,731,000	19,940,000	1,969,000	39,637,000	40,829,000	182,848,000	24,901,000			16,466,000	86,808,
0	0	442,468,000	415,188,000	27,280,000	3,718,000	47,011,000	81,548,000	190,389,000	31,208,000			22,302,000	10,055,
0	0	429,121,897	403,895,099	25,226,798	1,234,759	50,476,993	49,738,945	205,239,543	23,161,298			14,868,239	12,566,
0	0	320,440,000	316,806,000	3,634,000	530,000	32,574,000	43,610,000	140,927,000	19,068,000			10,837,000	12,053,
0	0	296,420,000	296,420,000	0		31,354,205	E	E 139,748,728	E	F	2,053,000	38,440,800	52,696,
8	L 68,475	295,801,000	127,238,000	168,563,000	858,000	21,093,000	23,623,000	121,174,000	9,050,000			7,734,000	45,685,
0	0	224,410,809	155,258,349	69,152,460	4,542,349	18,813,464	20,828,633	115,430,024	652,177		3,601,557	1,767,100	15,737,
0	0	210,132,192	208,209,900	1,922,292	146,669	35,340,621	68,909,586	27,608,813	24,225,647			27,738,200	1,903,
0	0	207,266,866	125,543,908	81,722,958	692,379	19,734,685	23,171,881	102,538,157	6,852,430			6,774,034	13,676,
0	0	199,494,332	195,750,527	3,743,805	900,447	18,198,692	17,080,673	47,255,056	5,673,635			31,352	61,566,
1	15,000	197,389,553	168,338,390	29,051,163	7,690,485	19,907,297	26,063,505	54,287,832	5,542,906				8,296,
0	0	189,363,937	159,991,790	29,372,147	530,378	27,102,646	14,214,744	92,123,249	6,865,946			2,577,484	12,923,
3	1,550	165,681,499	124,073,310	41,608,189		24,043,244	56,440,677	32,931,216	1,430,607			1,220,001	18,112,
0	0	85,026,898	85,026,898	0	757,476	9,296,584	18,337,247	28,311,686	877,449				8,259,
1	85,910	4,276,332,983	3,701,333,171	574,999,812									
1	293,400	889,321,000	887,797,000	1,524,000	2,448,020	35,146,354	34,910,520	580,616,429	7,854,981	G	20,295,447	57,426,399	2,941,
5	L 182,117	476,411,537	257,187,073	219,224,464	6,940,391	50,913,292	d	d 269,105,540	7,502,466			36,101,551	5,840,
8	71,500	402,651,686	376,999,629	25,652,057	17,493,281	28,602,035	21,722,983	42,562,908	8,526,806	F	212,801,703		4,902,
9	L 37,250	285,823,418	282,962,401	2,861,017	2,178,855	45,463,975	41,747,874	109,156,827	9,209,443			98,248	20,291,
8	70,050	218,534,735	218,534,735	0	5,605,227	0	0	0	0		59,990,044	0	75,457,
2	654,317	2,272,742,376	2,023,480,838	249,261,538									
0	L 877,144	4,048,123,590	3,101,236,879	946,886,711	541,409,226	430,293,098	288,152,453	1,218,912,524	52,917,924		0	256,433,173	157,694,
3	L 488,340	2,772,640,491	2,760,493,670	I 12,146,821	377,834,785	252,518,794	170,334,982	662,844,103	35,370,355	F	1,291,300	227,809,774	501,477,
5	L 216,175	788,481,852	744,017,181	44,464,671	36,048,254	115,254,618	156,597,830	204,320,305	4,548,830			53,309,662	21,318,
5	110,605	712,102,112	295,879,700	416,222,412		106,920,947	280,322,482	165,684,443	57,448,737				
2	203,534	634,984,182	622,875,340	12,108,842	18,711,005	78,355,500	61,381,252	258,373,746	5,721,518			39,149,961	46,994,
5	93,980	496,188,200	494,033,100	2,155,100		87,458,469	J 84,193,373	K 137,238,918	24,559,175			54,569,213	8,723,
2	100,080	478,306,895	466,922,655	11,384,240		32,186,535	11,105,133	45,618,965	2,129,760				303,556,
2	83,300	469,418,170	469,417,170	1,000	0	0	0	0	0		0	0	420,724,
0	0	356,207,095	360,083,132	F —3,876,037	0	M 178,239,778	M 93,921,372		4,239,633				29,415,
2	97,500	321,750,000	321,513,000	237,000		80,576,858	108,361,180	0	18,296,688				32,523,
1	58,575	300,679,349	O 245,414,012	P 55,265,337	40,765,847	16,781,540	26,492,487	104,839,326	810,524				14,818,
1	9,600	266,943,824	109,134,191	157,809,633	2,101,175	35,190,100	60,881,245	123,608,914	2,318,155				2,659,
3	114,000	229,619,600	229,401,600	218,000		38,774,841	23,903,928	101,568,098	8,909,902		5,146,594	980,669	5,429,
0	0	178,032,900	174,098,230	3,934,670		66,134,448	54,925,040		5,711,991			12,773,000	8,424,
9	L 22,567	173,930,919	125,214,688	48,716,231	15,441,612	39,762,226	65,519,476		2,658,912			1,693,480	2,731,
1	2,475,400	12,227,409,179	10,519,734,548	1,707,674,631									
9	971,200	4,990,727,444	3,103,510,004	1,887,217,440									
7	496,650	3,842,872,196	2,814,556,600	1,028,315,596	1,642,608	22,404,179	17,922,852	2,906,936,424	4,049,288				537,238,
8	486,245	2,689,161,650	2,687,383,598	1,778,052		17,008,302	5,497,288	1,399,729,560	1,151,050			3,472,880	1,185,353,
1	330,000	1,724,566,120	1,724,566,120	0	0	0	0	1,150,482,777	0		0	0	574,083,
4	215,410	1,529,382,839	631,028,720	898,354,119		121,691,089	166,306,856	588,608,231	18,224,451	S	286,163,739	119,717,889	23,504,
5	169,825	660,905,059	660,905,059	0	375,351	2,605,296	1,244,494	589,971,174	383,840				4,443,
2	L 96,234	508,256,900	398,289,900	109,967,000		179,153,416	74,274,466	44,403,745	14,780,365	U	130,541,300		501,
3	251,028	487,213,500	487,213,500	0		76,359,362	16,127,446	71,232,677	127,514,250		59,666,788	36,566,850	24,640,
9	94,375	474,553,410	474,553,410	0		11,117,122	4,969,598	409,759,699	766,134			485,516	
1	150,000	455,089,497	455,089,497	0		432,897		389,306,334					
1	75,000	428,956,100	428,956,100										
1	182,000	421,100,000	421,100,000	0	0	0	0	33,898,165	0		0	0	370,260,
5	167,325	389,102,000	389,102,000	0		71,590,428	50,203,426	135,102,330	11,399,956			75,118,899	6,071,
8	Z 48,000	227,324,308	227,324,308	0				29,464,000	1,806,000				
3	Z 62,955	199,952,617	199,952,617	0		283,755	239,320	144,169,310	24,000				45,239,
5	43,875	185,252,237	157,973,070	27,279,167	645,000	11,590,800	15,060,000	86,828,940	3,120,200			0	57,818,
2	38,200	173,949,572	173,949,572	0	61,253	85,230	46,681	155,349,635	41,701			1,145,118	14,359,
1	80,000	141,535,800	141,535,800	0	0	0	0	0	0		0	0	139,417,
3	45,000	135,786,020	135,786,020	0	0	0	0	0	0		0	0	135,786,
6	53,000	134,886,292	131,983,470	* 2,902,822	209,318	2,726,866	4,926,394	3,861,590	1,168,177				101,156,
2	4,019,337	19,800,573,561	15,844,759,365	3,955,814,196									
4	179,498	725,351,101	725,351,101	0	943,478	20,239,557	45,872,488	278,540,759	49,769,250	†	22,409,486	81,495,699	
0	0	1,147,920,881	1,143,131,780	4,789,101									
0	0	608,619,727	608,619,727	0									
0	0	594,098,027	0	594,098,027									
0	0	287,666,276	0	287,666,276									
0	0	284,602,140	201,826,640	82,775,500									
9	0	220,340,490	220,340,490	0									
0	0	212,161,952	157,697,952	54,464,000									
0	0	154,300,000	79,700,000	74,600,000									
0	0	141,511,652	6,005,852	135,505,800									
9	0	133,094,054	0	133,094,054									
2	L 16,000	115,356,150	90,526,700	24,829,450									
3	0	103,837,503	78,346,884	25,490,619									
0	0	75,368,837	32,609,910	42,758,927									
0	0	70,525,944	0	70,525,944									
2	16,000	4,149,403,633	2,618,805,935	1,530,597,698									

Summary of G

Section	Number of Companies or Systems	Number of Generati — All Plants — No.	Rating Kw.
United States	**137**	**1,863**	**30,473,841**
New England	14	169	2,293,703
Middle Atlantic	21	339	8,632,675
East North Central	29	276	6,718,368
West North Central	13	180	2,219,030
South Atlantic	15	237	3,136,447
East South Central	10	141	1,376,280
West South Central	15	235	1,452,809
Mountain	5	93	787,312
Pacific	15	193	3,857,217
Canada	**20**	**132**	**4,117,367**
Mexico	**1**	**16**	**211,738**
Railways and Railroads	**14**	**21**	**1,188,655**

,993,000	1,330,000	34,295,000	1,244	18,771	4,808	407	325				8	103
,808,000	2,158,000	87,055,000	1,522	77,746	20,954	2,117	1,098			2	20	104
,055,000	2,020,000	54,217,000	327	82,434	14,449	914	519			2	15	105
,566,712	2,441,711	69,393,697	1,058	96,636	22,821	8,605	826			2	26	106
,053,000		60,841,000	424	58,433	10,766	988	566			1	15	107
,696,900	2,100,582	30,025,785		69,064	12,464	1,081	538	F	1	1	7	108
,685,000	6,674,000	59,910,000	789	41,261	12,246	731	923			2	9	109
,737,618	7,443,976	35,593,911	320	32,659	7,900	352	27		15	1	13	110
,903,748	2,939,263	21,319,645	53	57,535	8,181	849	297			1	1	111
,676,650	5,747,278	28,079,372	1,049	41,340	10,302	2,414	232			2	6	112
,566,170	8,687,240	40,101,067	877	30,638	11,092	1,015	515			1	8	113
,296,695	25,524,161	50,076,672	1,438	34,799	13,236	691	297				9	114
,923,530	1,698,038	31,327,922	700	45,676	9,404	2,412	420			3	4	115
,112,091	672,933	30,830,730		50,569	10,275	231						116
,259,738	5,647,560	13,539,158	452	15,739	3,226	199	4				2	117
,941,480		147,681,370	1,867	51,786	10,689	210	87	G		2	7	118
,840,587	3,628,184	96,379,526	10,905	70,822	*d*	*d* 11,355	107			6	15	119
,902,220	3,090,949	62,948,801	8,838	25,142	4,473	1,046	579	F	3		5	120
,291,193	3,338,453	54,338,550	2,667	97,425	15,866	6,315	63			1	13	121
,457,417	43,161,962	34,320,085	4,231	0	0	0	0		347	0	9	122
,694,423	67,052,346	1,035,258,423	34,480	580,429	85,758	35,715	654		0	15	31	123
,477,446	4,612,411	538,546,541	14,516	396,062	49,829	20,292	343	F		3	11	124
,318,372	6,438,939	190,645,042	23,937	114,664	20,991	729	120			5	14	125
	4,956,483	96,769,020		214,728	51,532	2,909						126
,994,978	10,015,966	116,280,256	4,724	48,963	8,799	415	79			1	17	127
,723,984	3,690,689	95,754,379		J 89,292	J 17,911	K 418	449			6	7	128
,556,255	3,355,929	80,354,318		19,372	4,116	1,260	93				6	129
,724,800	20,305,298	28,388,072	0	0	0	0	0		0	0	1	130
,415,520	5,470,726	44,920,066	0	M 145,253	M 9,742		257				1	131
,523,824	9,984,633	72,006,817		80,884	12,842	1	1				1	132
,818,328	9,284,512	86,886,785	1,328	21,241	7,349	43	31				9	133
,659,211	3,455,196	36,729,828	3,694	30,502	5,725	4	23				5	134
,429,175	9,680,689	35,225,704		Q 32,629	3,838	1,272	1	R		1	13	135
,424,973	2,910,826	27,152,622		70,233	4,789		24			1	4	136
,731,048	4,360,927	41,763,238	8,070	33,136	7,776		109			2	4	137
												138
,238,985	18,351,488	334,326,372	6,222	40,180	10,987	296	306				5	139
,353,738		76,948,832		20,381	268	19	89			1	10	140
,083,343			0	0	0	4	0		0	0	4	141
,504,320		205,166,264		220,015	51,662	397	25	S	10	1	9	142
,443,606	3,464,269	58,417,029	83	2,976	517	6	4				6	143
501,720		64,601,888		40,556	6,034	*V*	6		2		1	144
,640,441	*X*	75,105,686										145
		47,455,341		10,850	2,625	46	15			1		146
		65,350,266		13		4						147
												148
,260,000	16,823,535	118,300	0	0	0	3	0		0	0	2	149
,071,513	7,435,125	32,180,323		80,628	13,896	2,727	16				2	150
	196,054,308											151
,239,985	801,967	9,194,280		848	2	4	1				12	152
,818,200		10,189,097	1,280	17,515	4,779	72	114			0	4	153
,359,200	278,560	2,582,194	85	195	85	9	3			1	1	154
,417,890	2,117,910		0	0	0	0	0		0	0	1	155
,786,020	0	0	0	0	0	0	0		0	0	1	156
,156,525	323,800	20,513,622	278	6,994	4,588	11	97				11	157
	7,561,278	218,519,106	95	123,575	46,985	286	1,560	†	27,892	2		158

of Generator Rating and Output

erating Plants and Generator Ratings— Fuel Plants No.	Fuel Plants Rating Kw.	Hydro Plants No.	Hydro Plants Rating Kw.	Energy Generated (Net), Kw.-Hr.	Energy, Purchased, Kw.-Hr.	Total Energy Output, Kw.-Hr.
960	**21,699,398**	**903**	**8,774,443**	**73,818,036,915**	**15,504,808,736**	**89,322,845,651**
44	1,579,912	125	713,791	4,920,826,592	1,474,672,464	6,395,499,056
143	6,825,693	196	1,806,982	22,150,509,206	2,994,762,120	25,145,271,326
144	6,409,132	132	309,236	16,513,590,010	4,838,989,218	21,352,579,228
112	1,678,939	68	540,091	4,997,656,063	125,163,272	5,122,819,335
124	1,768,164	113	1,368,283	6,076,099,783	2,634,165,510	8,710,265,293
116	555,847	25	820,433	2,914,806,704	905,120,171	3,819,926,875
214	1,366,899	21	85,910	3,701,333,171	574,999,812	4,276,332,983
21	132,995	72	654,317	2,023,480,838	249,261,538	2,272,742,376
42	1,381,817	151	2,475,400	10,519,734,548	1,707,674,631	12,227,409,179
10	**98,030**	**122**	**4,019,337**	**15,844,759,365**	**3,955,814,196**	**19,800,573,561**
2	**32,240**	**14**	**179,498**	**725,351,101**	**0**	**725,351,101**
19	**1,172,655**	**2**	**16,000**	**2,618,805,935**	**1,530,597,698**	**4,149,403,633**

interchange received.

J 6,371 customers in apartment houses and energy for these included under commercial small light and power (retail).

K Industrial light and power wholesale and retail.

L Leased plants.

The reported number and rating includes plants (in some cases not segregated as to kind of power) operated under contract or lease as follows:

Co. No.	No. of Plants	Kw.
2	1	50 (Hydro)
4	1	30,000
6	2	960
15	5	49,800
37	2	..... (Hydro)
47	1	18,000 (Fuel)
52	2	15,520 (Hydro)
78	5	119,400
80	6	978 (Fuel)
80	2	3,100 (Hydro)
86	1	7,500 (Hydro)
93	1	8,000 (Fuel)
94	1	3,000 (Fuel)
104	1	2,000 (Fuel)
109	2	488
119	5	28,300
121	1	600
123	6	107,200
124	1	1,800
125	1	5,500
129	1	15,000 (Fuel)
137	1	1,100 (Hydro)
144	2	96,234 (Hydro)
157	1	12,975 (Fuel)
169	2	16,000 (Hydro)

M Domestic and commercial light are combined under domestic; domestic and commercial power under commercial (retail). No. of active meters given under customers.

N Includes Nevada-California Power Co., Southern Sierras Power Co. and Yuma Utilities Co.

O Gross.

P Net; 58,730,146 kw.-hr. total purchased less 3,464,809 kw.-hr. delivered for exchange purposes.

Q Of these, 567 heat.

R Customers (public institutions) included under retail and wholesale commercial.

S Secondary or dump power.

T Standby.

U Off-peak.

V 1,467 customers included in other groups.

W Includes Manitoba Power Co., Ltd., and Northwestern Power Co., Ltd.

X Included under other sales.

Y Mainland system only.

Z Horsepower.

* Includes 2,584,842 kw.-hr. net interchange.

† Cooking and heating.

‡ Also one steam plant 9,600 kw. to Aug. 25, 1933.